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[OFFICIAL NOTICE.]

Annual Meeting, American Gas Light Association.

LAWRENCE, MASS., Sept. 11, 1889.

Section 12 of the Constitution is as follows:

"Section 12. *Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.*"

To the Members of the Association: Gentlemen—As already announced, the Seventeenth Annual Meeting of the Association will be held at Baltimore, Md., on Wednesday, Thursday, and Friday, Oct. 16, 17, and 18. The headquarters of the Association will be at the Carrollton Hotel, which is conducted on the American plan. The meetings of the Association will be held in the Concert Hall of the Concordia Building, on German street near Eutaw.

As, in my circulars of July 29, I had considerable to say in the way of impressing upon members the necessity of procuring rooms in advance at the hotel, it is not necessary for me to say much on this point now. I would merely add, as a reminder, that the rate at the Carrollton is $3 per day, and if the members take the pains to write in advance for rooms they will all be taken care of.

I am assured by the Committee that the hall selected for the meetings of the convention is in all respects a desirable place. Certainly this is a good cause for rejoicing, because a suitable hall adds greatly to the pleasure of the meeting.

The Council has appointed the following gentlemen as the Committee to nominate officers for the ensuing year, namely: Chas. H. Nettleton, Birmingham, Conn.; Edward Lindsley, Cleveland, Ohio; D. H. Geggie, Quebec, Canada; Geo. S. Hookey, Augusta, Ga.; Ed. G. Cowdery, Milwaukee, Wis. Members who desire to see the names of any particular persons nominated for officers should make their preferences known to the members of the Committee.

I am requested to state that special arrangements will be made at Baltimore for the entertainment of ladies accompanying members to the meeting.

There is no change in the literary part of the programme, which is as follows:

"Fuel Gas," by Walton Clark.

"Gas Coals of the United States," by H. C. Adams.

"Care and Operation of Gasholders," by C. L. Rowland.

"Illuminating Water Gas—Past and Present," by F. H. Shelton.

"Leakage and Condensation," by E. C. Jones.

"Purification of Gas from Kansas Coals," by B. E. Chollar.

"Conduct of the Electric Light Business in Connection with the Gas Industry," by W. H. Pearson.

"Advantages of Supplying a Mixture of Coal and Water Gas," by T G. Lansden.

"Some Thoughts on Fuel Gas, Induced from Practical Experience in the Distribution of Natural Gas," by John Young.

"Gas Calorimetry," by Prof. E. G. Love.

No particular effort has been made to add to the number of papers

during the last month, as it is thought that to thoroughly digest these dissertations will take up all the time of the meeting. I have the following conundrums for the Question-Box:

"Is it wise to make a special discount on gas used for cooking and heating?"

"Is the scheme of introducing air into gas for the purpose of reviving the iron a success?"

"What progress has been made this year in the matter of regenerative furnaces?"

"How shall firebricks and tiles be laid, wet or dry?"

"What composition of gas will give the highest illuminating power when burned with a common fishtail burner burning 5 feet per hour, and convert all of the carbon into CO_2?"

"What specific gravity of oil will yield the greatest amount of gas with the highest illuminating power?"

"What chemical change takes place when a liquid hydrocarbon is exposed to a high temperature and made into a permanent illuminating gas?"

If the members have any other questions for the box I would suggest that they be sent along as promptly as possible.

It has also been suggested to me that if I remind the members that there are four water gas processes in operation in Baltimore, the fact may serve as an extra reason why the members should strive to be present at the forthcoming meeting, as they will have the opportunity to examine these processes side by side, and thus be the more able to determine the value of each.

It is expected that the proper disposal of this programme in the allotted two days will be just sufficient tax on the energies of the members to make the relaxation of Thursday evening and Friday all the more enjoyable.

On the evening mentioned—the second of the meeting—the Association will be tendered a dinner by the Messrs. Bartlett, Hayward & Co. On Friday the Association will enjoy a sail down the beautiful bay, stopping at points of interest, and during the trip the members will be the guests of the Maryland Meter and Manufacturing Company. An inspection will also be made of the Chesapeake gas works, when we will be in the hands of the officers of the Consolidated Gas Company.

To the foregoing it is hardly necessary to add that the Baltimore meeting bids fair to be a profitable and enjoyable one. Each member should make strenuous effort to be present at the meeting.

The Trunk Line Passenger Committee and the Central Traffic Association have granted us the usual rebate on railroad fares—namely, full fare going, and returning at one-third the usual rate, or, in other words, one-third off on the round trip. Members who wish to take advantage of the rebate must obtain the necessary certificate from the ticket agent at the starting point. These certificates must also be endorsed by me at the meeting.

The gold badge of the Association has recently been sent to each member. If any one on our roll has not received the pin, I would thank him to inform me of the fact promptly.

Yours truly, C. J. R. Humphreys, Sec'y.

BRIEFLY TOLD.

The Baltimore Convention.—Ten days from now the sessions of the American Association will be in progress, and there is every prospect that a most profitable and enjoyable reunion will be had. The grand Triennial Conclave of the Brotherhood of Freemasons—to be held next week in Washington—will likely be the means of largely increasing the attendance at Baltimore in the week following, although it is just possible that the Washington conclave might exert the opposite effect; for a great many gas men will be in attendance at the Masonic ceremonies in the nation's capital, and as the celebration, which is arranged for on the most stupendous scale, is to last for several days, the Masonic gas men may find it difficult to remain away from home for such a lengthy season at this time of year, when the demand for their product begins to be so imperative. In connection with the Masonic gathering it might be well to note that two Past-Presidents of the American Association—General Charles Roome and Austin C. Wood—will figure prominently in the Washington Triennial. The General holds the position of reigning Grand Commander, while Brother Wood fills the chair of Grand Commander, Knights Templar, State of New York. To come back to the Baltimore convention, we make no doubt that the members have given Secretary Humphreys due credit for his successful efforts in securing a concession from the railroads in the matter of round trip fares. A 33 per cent. rebate is not an insignificant item, particularly when one has to cover a great many miles of ground. See to it, then, that you come equipped with the necessary certificate from the starting point. We can also say that the New England delegation will go to Baltimore in a special car to be attached to the train leaving the Boston depot of the New York and New England Railroad at 6 o'clock, Monday evening, October 14. The route will be N. Y. and N. E. to Newburgh, Erie to Jersey City, and Pennsylvania to Baltimore. We feel that it is hardly necessary to remind the members again of the benefit that arises from attendance at these gatherings; but will venture the advice that every one who possibly can go should be in Baltimore on the days named in the circular.

Obituary, L. C. Kingsbury, Corning, N. Y.—One man who often gathered with his fellows in the convention halls of the American Association will never again answer to the Secretary's roll call. We refer to the late Mr. Lewis C. Kingsbury, who for years (in fact, since 1862) had been one of the proprietors and President of the Corning (N. Y.) Gas Light Company. Deceased was born (December 31, 1815) in Livonia, Livingston county, N. Y., and in his 28th year he engaged in business as a storekeeper in his native township. After his marriage (1843) he removed to Conesus, N.Y., and remained there in mercantile business for about 10 years, at which period he became interested in the development of the Conhocton Valley Railroad—since absorbed into the Erie system. After the consolidation of the roads Mr. Kingsbury served for some years as a passenger conductor on the Erie line, and followed his retirement therefrom by the establishment, in conjunction with A. T. Cochran, of a carriage manufacturing business in Corning. In 1879 deceased purchased what was known in the neighborhood as the "Dodge Farm," which place is now noted as one of the most beautiful and productive acreages in that portion of the State. He was elected to membership in the American Association at the meeting of October, 1873, and while never prominently before the Association as a contributor of papers or as a participant in the discussions, his influence—particularly in the earlier years, when the Association required support of a practical nature for its existence—was often felt for good. We must mourn at his death for the loss of a useful and valuable citizen, whose life and example are of the sort calculated to strengthen confidence that reward comes to those who merit it. Mr. Kingsbury died on September 5th, and the remains were interred in Hope Cemetery on the following Sunday.

Obituary, T. A. Cosgrove, Evanston, Ills.—And another (whose sudden summons to join the great majority will cause many a regretful pang) of the craft to pass away was Mr. Thomas A. Cosgrove, whose genial presence and kindly greeting often helped to make glad the trysting places of the Western Association. Mr. Cosgrove's summons came on the morning of Wednesday, September 25th, and with his demise was ended a life of singular purity of purpose. Deceased was born at Piqua, Ohio, on November 12, 1832, from which place his parents shortly removed to South Bend, Ind. Left an orphan in his 15th year, young Cosgrove had to face the battle of life at a very tender age, but with that vigor which was so markedly characteristic of the man, the boy fought the battle manfully and well. After many ups and downs, we find him, at the age of 24, in Champaign, Ills., engaged in the banking business. He remaining here, all the time moving onward and upward, until 1868, removing then to Evanston, Ind., where he became actively interested in real estate operations. With his partner's aid—the firm name was Hodges & Cosgrove—the village of Ravenswood was laid out, and the "Cosgrove Addition" to Evanston will long serve to perpetuate his name. In 1873 he purchased a controlling interest in the Northwestern Gas Light and Coke Company, to the development of which his best energies were directed. His success in this respect is open history to the Western fraternity. He sold out his interest in the Company about a year ago. Deceased was virtually a charter member of the Western Gas Association, having been admitted to membership therein on the occasion of the Chicago meeting in 1879. He served the Association in many ways—both as a contributor and as an officer—and his death will but serve to emphasize his faithfulness to the Association's best interests. His was a life of fidelity and uprightness.

A new organization has entered the field of regenerative lighting for the purpose of prosecuting the sale of regenerative gas lamps manufactured under the Wenham and Lipsey patents, and is known as the United Gas Lamp Company. The proprietors have acquired control of the premises No. 825 Broadway, this city, for office purposes, and show warerooms. The manufactory, which is quite complete, is located on 13th street, near Fifth avenue.

The plant and property of the East End Gas Company have been acquired by the Pittsburgh Gas Company.

Mr. S. P. Hamlin has been appointed Assistant Superintendent of the Jamaica Plain (Mass.) Gas Company. He was formerly in the service of the Dedham and Hyde Park Company.

Mr. I. P. Hyde has been elected Treasurer of the Mutual Gas Light Company, Southbridge, Mass., vice Mr. C. A. Dresser, resigned.

Instruments for Measuring Radiant Heat.

By C. V. Boys, F.R.S.

[A lecture (Cantor series) delivered before the Society of Arts, London.]

At the time that I was honored by the invitation to give a course of Cantor lectures I was so much absorbed in my experiments on the development of instruments for measuring radiant heat, that I naturally turned to that subject as one which I hoped would be worthy of being discussed in the rooms of the Society of Arts. However, now that the time has come when I have to put before you an account of the different instruments of this class that have been made, and of the principles upon which they depend, I feel, when I consider what splendid courses of Cantor lectures have been delivered in this room, how utterly unable I am to follow in the steps of those that have gone before me, or to treat my subject in the manner that it deserves.

When an ordinary candle burns, heat is developed, which escapes chiefly in the stream of hot air which rises from the flame. This stream is sufficiently powerful to keep a screw of paper at a height of six feet constantly rotating. If there are many candles or lamps, then the number of separate streams unite in a lake of hot air, which may be found resting under the ceiling of the room. Heat escaping in this way is said to escape by convection. If a piece of copper wire is placed with one end in the flame it also becomes hot, and some heat escapes along the wire, so that a ball, supported by wax, falls when the wax is melted, or a piece of phosphorus catches fire, or the fingers holding the wire are burnt. This passage of heat through a material which it warms is called conduction. Finally, if the finger is held a few inches away from the flame, and about level with it, though no hot air is driven in that direction, the finger clearly feels the sensation of heat. Heat is escaping in all directions from the flame without warming the air round about and without being sensible until it falls upon some obstruction, when its existence becomes known. This heat escaping by radiation may be felt in any room in which a group of gas burners is alight. All that is necessary is to take a sheet of tin plate and hold it in such a position as to reflect the light—and therefore the heat—on to the face. If the plate is suitably bent by hand, not only will it be filled with light, but the heat which then falls on the face is evident at the distances at which we might think some very delicate apparatus would be necessary to detect it. The heat felt under these conditions travels through air without appreciable absorption, just as light does. The air is not warmed in the process; the energy of the radiation passes on unchanged, and only becomes sensible as heat when it meets with some obstruction. In the case of the sun, no heat can escape by convection, for there is no atmosphere outside it in which currents can be produced. None can escape by conduction, for it does not rest upon anything. All the heat which reaches the earth from the sun, all which leaves the sun at all, is, as far as we know, due to radiation.

The relative amount of heat which escapes from hot bodies by the three processes which have been described—convection, conduction and radiation—varies very widely; but in general, except among the heavenly bodies, the first two between them are far more important factors in the cooling of a body than radiation. The amount of heat which escapes by radiation is freely radiated into all space, so that if the obstructing body is small, or is any considerable distance away, but a small proportion of the radiation falls upon it, the rest, of course, escaping in all directions. For these two reasons instruments which are intended to measure radiant heat, as it is commonly called—or radiant energy, which is a better term—must in general be capable of showing quantities of heat which are very small in comparison with that stored or developed in the radiating body.

These instruments differ from thermometers, in, that when a thermometer gives a steady reading temperature is indicated, and there is no heat flowing to or from the thermometer. On the other hand, with instruments for measuring radiant heat, instruments that would be called radiometers if Mr. Crookes had not already given that term a special meaning, the actual temperature of the hot body is but one of the numerous factors which determine the indication of the instrument, and, further, the instrument only gives a steady indication when the rate at which it receives heat from the hot body is equal to the rate at which the part of the instrument heated by the radiation loses heat in consequence of its excess of temperature. At first the exposed part increases in temperature; as it is warmed it loses heat, generally in all three ways, by conduction, convection and radiation; this loss becomes faster as the temperature rises, and in time a steady state is arrived at, when the rate at which heat is received is equal to that at which it escapes.

Among instruments for measuring radiant heat I cannot do better than at once refer to the thermometer with a blackened bulb *in vacuo*. This instrument will, of course, in time, show the temperature of any inclosure in which it may be placed; it then acts as a thermometer simply, and the vacuum round the bulb merely serves to make the process of acquiring the temperature of the inclosure slower than it would be if the intermediate space were filled with air; or it may be exposed to the sun's rays, in which case, if it did not lose heat at all, it would go on rising in temperature, slowly, possibly, but still without stopping until it acquired the temperature of the sun or was destroyed in the process. In this instrument everything is done that can be done to reduce the loss of heat. Because the bulb is in a vacuum, convection of heat is prevented; because the bulb is only supported by a slender stem of glass, conduction of heat to the outer world is almost inappreciable. However, radiation remains, and it is this that determines the temperature to which the bulb will rise when exposed to any given source of radiation. Though the rate at which the bulb loses heat at any given temperature would be diminished by silvering it, such a silvered bulb would not become actually hotter, because it would absorb heat more slowly in about the same proportion. The chief advantage that is obtained by the use of the black surface is quickness, for both the gain and the loss go on at a higher rate than would be the case with any other surface, and, therefore, the final or steady state is more rapidly brought about. This instrument would more truly measure the relative heat of the sun's rays if it were fixed in a place having a constant temperature. When it is simply placed out of doors it is impossible to say what the temperature of the surrounding bodies—the ground, the walls, the sky—really is; but, on the whole, the rate at which heat leaves the bulb is greater in winter than in summer, for a given temperature of the bulb, and, therefore, the temperature to which it will rise for a given rate of radiation, is less in winter than in summer. I have referred to this instrument at this stage because it illustrates well the difference between a thermometer, as commonly used, and an instrument for measuring radiant heat. It serves both purposes. It shows the temperature of an inclosure when outside radiation is prevented. By its excess of temperature above that of surrounding bodies it shows at what rate heat is being poured into it from the sun or other radiating body.

All instruments when used to measure radiant heat have in the same way some exposed part or sensitive surface, which is heated to such a temperature that it loses at the same rate that it absorbs heat; but in almost all cases there is this difference—instruments for measuring radiant heat do not as a rule give any indication of the actual temperature of the sensitive surface, but only of the excess of the temperature of this over that of the rest of the instrument, and thus these indications are equally valuable whatever the actual temperature may be.

When heat falls upon a thing and warms it, the rise of temperature produces a variety of physical effects, some of which are made use of to determine the rise of temperature, and therefore the rate at which heat falls upon the surface, while most are not conveniently available for this purpose. In the first place, whether the thing is a solid, or, if hollow, it contains a liquid or a gas, the rise of temperature in almost every case produces an expansion which may be made apparent by mechanical or electrical means.

If the thing that is warmed consists of a junction of two metals, an electromotive force is set up, producing a current the strength of which may be made a measure of the increase of temperature.

Or, again, if the thing that is warmed consists simply of a strip of conducting material, its electric resistance is altered—increased generally, but decreased in the case of carbon—by a rise of temperature. Any change in the resistance of one part of a circuit through which a current is sent from an external source will alter the strength of the current, and if, by means of a differential galvanometer or Wheatstone's bridge, the effect of the current is balanced, then a change in the resistance will upset the balance, and this disturbance can be made evident by a galvanometer.

These three effects of heat—expansion, thermo-electromotive force and change of resistance—are the only ones which are turned to account in instruments for measuring radiant heat.

Let us first consider the few instruments that exist in which some material exposed to the radiant heat is expanded by the rise of temperature, and in which the change of volume gives rise to visible effects.

There are many ways of showing, with magnifying levers or other contrivance, that a rod of almost any material is lengthened by heat, but these are so insensitive that they would be quite unable to detect such feeble radiation as is easily measured in other ways. The expansion of a piece of brass wire, or even a glass rod, when slightly warmed, may be shown easily enough by allowing the end to roll over a fine

needle to which a straw is fastened as an index. Captain Cardew measures the rise of temperature in the wire in his voltmeter by magnifying the expansion with a wheel and pinion. The rise of temperature here, it is true, is not produced by radiation, but is the indirect result of the electromotive force to be measured; but I refer to it as it is one of the few practically useful instruments in which expansion produced by a rise of temperature in a solid is magnified and made evident by mechanical means.

Professors Ayrton and Perry magnify and measure the elongation due to the rise of temperature in the wire in their voltmeter by a very elegant device (Fig. 1). In the first place, there is a fine wire stretched be-

tween two fixed points, *a a*, and pulled on one side by the action of a spring, *d*. When the wire is warmed, the spring pulls it a little further to one side, because it is longer, to a position shown by the dotted line. Now the additional distance to which the wire is pulled to one side is greater than the increase in length of either half of the wire, in the same proportion that *a c* is longer than *b c; i. e.*, it would be longer in this proportion if it were not for the fact that, as the angle at *c* diminishes, the power of the spring to stretch the wire diminishes also; nevertheless, the lateral motion at *e* is itself considerably greater than the expansion of either half of the wire, and this increased motion is itself enormously magnified by the action of the spring itself. The spring is made with a twisted ribbon of the same shape as the shaving that is produced when a plane, held at an angle, takes a shaving off the edge of a plank. Such a spring (as Professors Ayrton and Perry have shown) twists through a large angle when it is pulled out, even through a small distance; therefore, a balanced index on the end of the spring again magnifies the stretch of the wire, and thus a very feeble rise in temperature is made manifest.

I do not think that any one has suggested that these instruments might be used with advantage to measure radiation falling on the wire, nor do I think that any instrument depending on the expansion of a solid could compare in sensibility with those to be described.

The only instrument that I can remember that has been seriously put forward as a delicate means of measuring radiant heat, which does depend on the expansion which a rise in temperature produces in a solid body, is the tasimeter of Edison.

In this instrument the part of the apparatus exposed to radiation is a thin strip of vulcanite or of zinc, which is supported between a screw at one end and a carbon resistance at the other, so that when it expands by heat it shall increase the pressure on the carbon wafer, and so diminish its electrical resistance, an effect which can be easily and accurately observed by well known electrical methods. There is a good account of this instrument in the *Telegraphic Journal*, of November 15, 1878, by Prof. Barrett, from which it is possible to get some idea of the sensibility of the tasimeter. The following paragraph copied from the *Journal* indicates what the instrument will do:

"The heat radiated from one finger held near the cone is more than sufficient to drive the galvanometer index right across and off the scale. In a letter relating to this tasimeter, Mr. Edison writes to me as follows: 'By holding a lighted cigar several feet away I have thrown the light right off the scale,' and by increasing the delicacy of the galvanometer 'the tasimeter may be made so sensitive that the heat from your body while standing 8 feet from and in a line with the cone, will throw the light off the scale, and the radiation from a gas jet 100 feet away gives a sensible deflection.'"

Professor Barrett went on to say that he considered the tasimeter to be a more sensitive instrument than the thermopile, as a thermoscope, but he did not think it would replace the thermopile, except, possibly, in investigation of the heat of spectra, owing to the linear form that can be given to the ebonite bar.

I have had no experience with this instrument, and, therefore, what I have to say is only an opinion based on experience of instruments of the highest degree of sensibility, and upon our general knowledge or rather ignorance of the behavior of carbon resistances.

There seems to me to be one fatal defect in this instrument as an instrument of precision intended to be used in exact investigations. The indications of the instrument are perfectly arbitrary. We do not know the law according to which the resistances of these carbon wafers change with change of pressure. Though, as Professor Barrett says, as a thermoscope the instrument may be more sensitive than the ordinary thermopile, which at that time was the most delicate instrument in common use; though when nicely adjusted it might detect a minute change in the radiation falling upon it, the deflection of the galvanometer needle gave no measure of the amount of this change. But if the only fault was that the effect produced was not exactly proportional to the cause, a property common to many most useful instruments, this would be no great objection, for all that would have to be done would be to find out what deflections regulated additions of heat produced—it would be merely necessary to calibrate the instrument. But this, I believe, is impossible: I do not believe that if the instrument were set up and the calibration curves determined a dozen times, that any two of these curves would be the same. I simply state my belief; if I am wrong, I hope I may be corrected as speedily as possible. It is for this reason that I look upon this instrument simply as a scope, and not a meter.

Finally, among delicate means of observing the expansion of metal may be mentioned the well known metallic thermometer of Breguet, which consists of three strips of metal—silver, gold, and platinum—soldered together face to face, and wound into a helix. During any change of temperature, the three metals change in length by different amounts, the platinum least and the silver most, and therefore the helix winds up or unwinds. This instrument, like the thermometer, essentially shows actual temperature, and not excess of temperature above surrounding bodies, a feature which does not belong to the voltmeters already mentioned, in which a change of temperature in the whole instrument produces no effect, for all the parts are made to expand alike.

The expansion of a solid might be practically employed in an instrument for measuring radiant heat solely because the solid can be rolled or drawn into very thin strips of wires, which quickly take up the final temperature. The expansion of liquids in tubes cannot conveniently be employed for this purpose, because the amount of liquid that would be sufficient to produce a visible effect would be so great that the time occupied in coming to the final temperature would be enormous. It is only in such cases as that already referred to, where a thermometer *in vacuo* is used to measure the sun's radiation, the changes in which are comparatively slow, that a liquid can be used with any advantage to measure radiant heat.

If the capacity for heat of the bulb of the thermometer is known, and the rate at which it rises in temperature when exposed to the sun's rays, and the average falling in temperature when the sun's rays are screened from the instrument, then, knowing the area exposed by the bulb, we have at once the means of determining absolutely the rate at which heat is reaching the surface of the earth. This measurement is, however, more accurately made by a class of instruments devised for the purpose, of which one of the best known is the pyrheliometer of Pouillet. This consists of a thin box of metal with a flat base; the box is filled with water, and there is immersed in the water the bulb of a delicate thermometer, the stem of which passes down the tube of the instrument. At the lower end of this tube is fixed a disc the same size as the base of the box, so that the observer can, by casting the shadow of the box on this disc, place the bottom of the box square to the rays from the sun. As before, if the capacity for heat of the box, and the rate of heating in the sun, and the average rate of cooling when shaded are determined, we have at once a measure of the rate at which we receive heat from the sun.

(To be continued.)

A Continuous, Regenerative Gas Kiln for Fire-bricks.

In former years, the "Newcastle" kilns were the only ones employed in Scotland for the burning of fire-bricks, but at the Glenboig and Cumbernauld Works, near Glasgow, Scotland, a most important advance has been made in recent years by the introduction of the "Dunnachie Continuous Gas Kiln." This kiln is constructed of two rows of fire chambers, all connected with each other by means of flues underneath the floors. By means of these flues the gaseous fuel is obtained from gas producers. A continuous firing is thus maintained, and the heat regenerative principle involved has resulted in the most efficient and economical system of burning fire-brick yet known. As compared with the "Newcastle" kiln and the older method, the saving in fuel has been found to be from 50 to 75 per cent.—at Glenboig the latter figure has been attained. Since the introduction of this system at Glenboig, in 1881, the Dunnachie kiln has been applied at various other establishments for the burning of other classes of bricks, pipes, tiles, pottery ware, etc., with much success.

Secondary Air Supply to Ordinary Retort Settings.

By W. J. Best.

[A paper read before the Second Annual Meeting of the Eastern Counties (England) Gas Managers' Association.]

I would most respectfully ask you to allow me to relate some experience in adopting a secondary air supply to ordinary retort settings, which I will try to do as briefly and explicitly as I can. It has often been a source of annoyance to me, on comparing the statistics of some gas companies, to find that, after taking into consideration the quantity of coal carbonized, my fuel account is considerably in excess, as compared with those companies. I am aware that, having a small works making about 7,000,000 cubic feet per annum, great things cannot be expected in this direction, more especially during the Summer months when the demand for gas is limited, and the fires have to be kept up and retorts often standing idle. Of late years a great amount of labor and attention has been expended by various companies in the reduction of the fuel account by the adoption of regenerative furnaces, but for numerous reasons these hardly come within the practical reach of small works, and in my own case are altogether out of the question, through the liability to floods. The only resource left open was to see what improvement could be made in the present settings. On observation, I noticed, in the ordinary course of events, that the flame from the furnace extended, not only into the main flue, but sometimes into the chimney stack, or until it found a sufficient quantity of air to complete its combustion. This was anything but a desirable state of affairs, and clearly proved that this kind of thing was a waste of both heat and fuel, and that the furnace required more air than was generally supplied through the fire bars, so as to complete the combustion within the setting. With a view to remedy the above-named defect, I prepared a plan for the introduction of a secondary air supply to the furnace, and communicated with my retort setters, who, in reply, stated that they had themselves been experimenting in this direction, and that having in stock the necessary specials for this kind of setting suggested that I should try the same. Their system somewhat differed in detail from my own, but the object being the same, with a view to economy and other reasons, it was advisable to adopt their system. In order to make everything plain and intelligible, I have before you plans of the retort setting now in use at St. Ives, which I will endeavor to explain. The primary air supply is admitted to the furnace in the usual way, and is regulated by a damper, the frame of which is bricked in on a level with the retort-house floor and over the front of the ashpit. Apart from regulating the primary air supply this will also be found a useful arrangement while the stoker is charging the retorts, during which operation this damper may be nearly closed, which prevents any coke or coals from falling into the ashpan, and again withdrawn to its proper position immediately after charging. The furnace is of the usual type, but, in order to secure a good depth of fuel, which is an important consideration, the furnace is fitted with a frame having two doors, one above the other, so as to facilitate this object. The secondary air supply is also regulated by a damper, and is admitted at the front, carried along under the flue of the bottom retort the whole length of the setting, up the back and into the air bricks, is further conveyed by these to the front of the setting, and on its return journey finds its exit through the port-holes of the air bricks, which are so arranged between the transverse walls as to bring the secondary air into direct contact with the gases evolved from the furnace. I scarce need point out to you, from the way the secondary air is conveyed into the setting, it not only becomes highly heated, but is equally distributed throughout the whole length of the setting. This not only secures a uniform admixture of the gases, but is also a safeguard against local heating. In order to ascertain when the relative dampers are arranged so as to prevent the flame from traveling any distance beyond the setting, it has been necessary from time to time to remove one of the coverings above the main flue. The inconvenience attending this operation induced me to have a special quarry made, with a 6 inch hole, and placed on the top of the flue in such a position as to bring the hole immediately over the damper of the setting. This is again covered with a small tile, which is at any time easy of removal. You will observe that this system of secondary air supply is applicable to any existing arch, or any form of retort setting where a retort is not located immediately above the furnace, and does not require any flues below the floor level, or diminish the area of any existing flues of an ordinary setting. Having endeavored to explain the setting as clearly as I can, I will now state some practical results in working with the same, as compared against an ordinary retort setting; and for this purpose I considered it would be more advisable to embrace a period of time extending over six months' working, as a more reliable test than a shorter period; and in order to arrive at the fuel account, after making the proper allowance for the stock of coke, the quantity sold has been taken as a basis. This showed an increased sale of coke equal to 20 per cent. in favor of the new setting, while the heats greatly improved, and the charges, which formerly took five hours to burn off, were now better done in four hours. Apart from this, owing to the greater heats and more rapid production of gas in the retorts, the make of gas increased at the rate of 700 cubic feet per ton of coal carbonized. It was also noted that on an average of a week's working the production per retort was 6,700 per 24 hours, as against 4,300. The size of the top retorts is 21 inches by 14 inches by 8 feet 3 inches, the bottom 16 inches by 14 inches by 8 feet 3 inches. In order to accommodate the gas plant generally and to nurse the recuperative power of the furnace, some time is allowed to elapse between the charging of each retort. I need not further dilate on the merits of this setting; the results derived from the same were a sufficient reason for me to have another setting on this principle erected this summer. In conclusion, I may state that the advantages secured by this setting, and its adaptability to existing arches, together with the small cost beyond the ordinary retort setting, bring it within the practical reach of any small gas company, and that with satisfactory results.

Discussion.

Mr. J. T. Joliffe thanked Mr. Best for the paper he had read and the interesting plans he had explained; but he was sorry the author had not carried his idea further. The introduction of secondary air at the point indicated would be, perhaps, of some value in decreasing the temperature on the furnace bars, but beyond that he questioned whether the results would be very beneficial. All their efforts should be in the direction of recovering the waste heat that in all settings found its way to the chimney—heat which bore a certain proportion to that generated in the chamber. Referring to the subject of regenerator furnaces, Mr. Joliffe explained that he could not introduce them because water below the surface prevented him excavating, and the roof overhead was low and prevented him ascending. He might tell the meeting, however, that he did all he could to utilize the heat after it had done duty in the ovens. With it he raised steam in a boiler 30 feet long and 7 feet in diameter. This heat came from five settings in which there was no extravagant use of fuel. The steam thus generated was used to drive the pumps and exhausters, and to work the sulphate plant, and those that made sulphate knew what a large drain on the boiler it involved.

Mr. J. Barton was sorry that Mr. Best had not added to the value of his communication by supplying the more detailed results of his working, especially with regard to the consumption of coke. So far as he could see the setting was a good one for ovens of threes and fours; but he was not certain whether the extra expense of erecting would not counterbalance any saving that might be effected. No doubt Mr. Best said he had made a saving of 20 per cent. on the coke account, but he had not told them what the account was prior to the introduction of the new system. He would like to know how long the retorts would work. Was there any cutting at the bottom of the two top retorts, or was the draught equalized so as to prevent cutting? At Peterborough he had a system of admitting secondary air differing from that described by Mr. Best. His settings were sevens, and he could not carry the air over the arch. The channel was in the bottom bed, and the air was regulated by three port holes. By his system he had reduced the fuel from 33⅓ to something like 24 per cent., and he got better heats, but not the results achieved by Mr. Best. His retorts would last for three years, or from 700 to 800 working days.

Mr. A. Mitchell said he was placed in the same position as Mr. Joliffe with regard to regenerator furnaces. He did not have this system at the works under his control. He was strongly of Mr. Joliffe's opinion, that the great thing to aim at was to utilize the heat which at present found its way to the chimney. If settings were to be improved, two or three points would require to be observed. For instance, the furnaces would require to be made deeper than they have hitherto been made, and the firing should be done by means of hot coke. This latter point was highly important, because if coke which had been saturated with water were used there would be a loss of energy before proper heats could be secured. He would also advocate an arrangement of flues under the settings so as to utilize the heat that now passes away to the main flue. This might be done by having a certain depth of brickwork in which the flues could be built. This would enable them not only to heat the secondary air, but to conserve a great deal of the heat given off by the fuel employed. By this he meant that this body of brickwork would retain that heat and communicate it to the settings as well as to the secondary air. He could not say that he liked Mr. Best's idea of heating over the top of the arch, because in his view the waste heat

could not be sufficiently utilized. While he said this he thanked Mr. Best for his paper. There was sufficient matter in it to cause them to think.

Mr. Brockway said the paper was of great value to managers of small works, like himself. He had no experience of the system, but the results achieved by Mr. Best must induce members to think about it. Certainly, as the outcome of hearing the paper, he would visit St. Ives to examine the setting, with a view to its adoption if it satisfied him. He might point out that Mr. Best, in referring to the time of working off the charges, did not specify the coal he had used.

Mr. A. Drage said he could not satisfactorily work the regenerator system. He had tried to use the waste heat to raise steam, but by doing so he found that he cooled down his retorts.

Mr. D. F. Goddard said that, having no experience with regenerators, he could not speak of their efficiency or otherwise. What struck him, however, as worthy of note was that the managers of comparatively small works were now experimenting in several branches of the industry, with the view of producing gas better in quality than hitherto, and more economically. This was as it should be, because the conditions applicable to large works were not applicable, except in a general sense, to small works. Experimenting had not been carried sufficiently far. To deal with a complete system of regeneration necessitated considerable experience and considerable outlay, which one would not expect in small works; but the managers of these works might employ themselves in adapting principles found to be advantageous in large undertakings to the works under their command. This was what Mr. Best had done. One of the advantages said to be gained by the system which had been described was that a charge formerly occupying five hours could now be worked off in four hours. Now, he did not see that there was much advantage to be gained in turning out a charge in quicker time. He had experimented in the direction of getting charges off quickly, but there was always a difficulty. Rapid carbonization led to stopped ascension pipes. He did not know whether Mr. Best had any experience of this kind, but if he continued to work long enough he would sooner or later be troubled with choked ascension pipes.

Mr. James W. Helps had not heard the paper read, and could not, therefore, offer any criticism upon it; but he might say that he agreed with the views expressed by Mr. Goddard, that to force carbonization led to trouble with ascension pipes. That was an important point, and one which should not be lost sight of. Experiments which simply aimed at getting off a certain quantity of gas could not be said to be satisfactory.

The President thought that every one must be satisfied with the discussion that had taken place, yet he considered that the nail had not been exactly struck on the head. Mr. Best said he carbonized a charge in four hours, instead of five hours as formerly, and that he got 6,700 cubic feet per mouthpiece in 24 hours; but he had not given the illuminating power of the gas with the five-hour and with the four-hour charges. He did not care a fig about the objection relating to stopped ascensions. Any temperature might be employed if only the ascensions were adapted to the purpose for which they were intended. At Grantham he worked with high heats, and for 15 years he had not had 15 pipes stopped. There must be a serious blunder when pipes were being continually stopped. He quite agreed with Mr. Goddard that the regenerator system was expensive, and that it was not always beneficial. It was consequently wise to wait. He was of the opinion that there was something in the system advocated by Mr. Best, and he thought that all its advantages had not yet been discovered. He should watch Mr. Best's working with interest. He remembered, when traveling in Scotland, of calling upon Mr. Watson, at Stirling, and seeing a very simple arrangement of introducing secondary air in operation. Mr. Watson introduced a three-quarter or inch pipe at the front of the retorts. On this pipe there was a stopcock, so that the supply could be regulated. The arrangement was simple, and it worked admirably. The President concluded by complimenting Mr. Best on the paper he had read, but at the same time he must say he could not indorse all his views.

Mr. Best then replied. He said he quite agreed with Mr. Joliffe that the waste heat ought to be utilized. He hoped that in the near future he would be building a new retort house, and then he would do something in this direction. With respect to Mr. Barton's question, he found no cutting action or more than the ordinary wear and tear. The principal disadvantage of the arrangement was the narrowness of the arch. It was only 5 feet 10 inches; and after a little time—say about four months—the furnace required to be repaired. He might say, in answer to another gentleman, that he got better heats with the same amount of fuel. He fully indorsed the view expressed by Mr. Mitchell, of firing with hot coke. While he thought that high heats had a tendency to cause stopped ascensions, he was pleased to say he was seldom troubled with them. He adopted the plan of allowing cold water to trickle down the pipes, and this prevented stoppages. The coal he used was Aldwarke Main. Carbonizing with four-hour charges, he never recollected of drawing a charge that was not thoroughly exhausted. As to the illuminating power, he used a jet photometer, and his stoker had strict injunctions to see that it did not indicate under 17 candles. He was able, by charging the retorts alternately, to keep the jet pretty steady. He should be pleased to show the setting to anyone.

A New Method of Stocking and Reloading Coal.

The stocking is accomplished by means of an endless chain, carrying flights or scrapers, 8 inches by 20 inches, spaced 2 feet apart on the chain, which passes over a sprocket wheel, situated under the railway from which the coal is discharged, and around a traction wheel secured to the upper end of a vertical guyed pole, 50 to 75 feet in height, and distant from the railway from 100 to 200 feet. For the lower part of the chain there is no support between the foot and head wheels, but the return portion is borne up by idler wheels, at intervals of 50 feet, suspended from wire cables or supported on light trestle work. The flights on the chain scrape the coal from the place where it is tipped up the face of the heap, forming a conical pile with its apex under the chain, until it ultimately takes the shape of a bin "65 feet high and 300 feet across its base, and containing about 20,000 tons." The apparatus is stated to have a capacity of two tons per minute, and four machines are in use at the wharves of the Philadelphia and Reading Railway Company, who bargained that the contract for the new stocking system should pay for all breakage of coal in excess of their previous average. When the coal is carried up at an angle of one in two, pieces of old boiler plate are laid down every 10 to 15 feet, "with the round side up," so as to ease the scrapers; and when it has to be carried up at a much higher angle, troughs with high sides require to be used for the scrapers to work in, and it has been stated in discussion that at the mines these troughs are from 8 to 24 inches wide, and rise 7 inches to the foot, and that the wear of the coal in them was very slight. The stock is reloaded into wagons by a conveyor, which is pivoted at the railway loading place, and is moved sideways on to the pile, and carries the coal into an inclined conveyor, which elevates it to a loading hopper, from which it is discharged into the trucks.

The Morse and Springer Process and Apparatus for the Manufacture of Gas.

U. S. Letters Patent (No. 411,389) were granted on Sept. 17 to M. A. Morse, of Chicago, and T. G. Springer, of New York, for certain improvements in the process of and apparatus for the manufacture of gas. The following is an abstract of the specifications of the inventors:

The invention relates to the manufacture of illuminating gas in cupola generating furnaces, and more particularly to the economical method and means for carbureting, combining, and fixing water gas; also, to improvements in the construction of the cupola generating furnace, whereby it may be more readily charged with fuel and cleared of clinker.

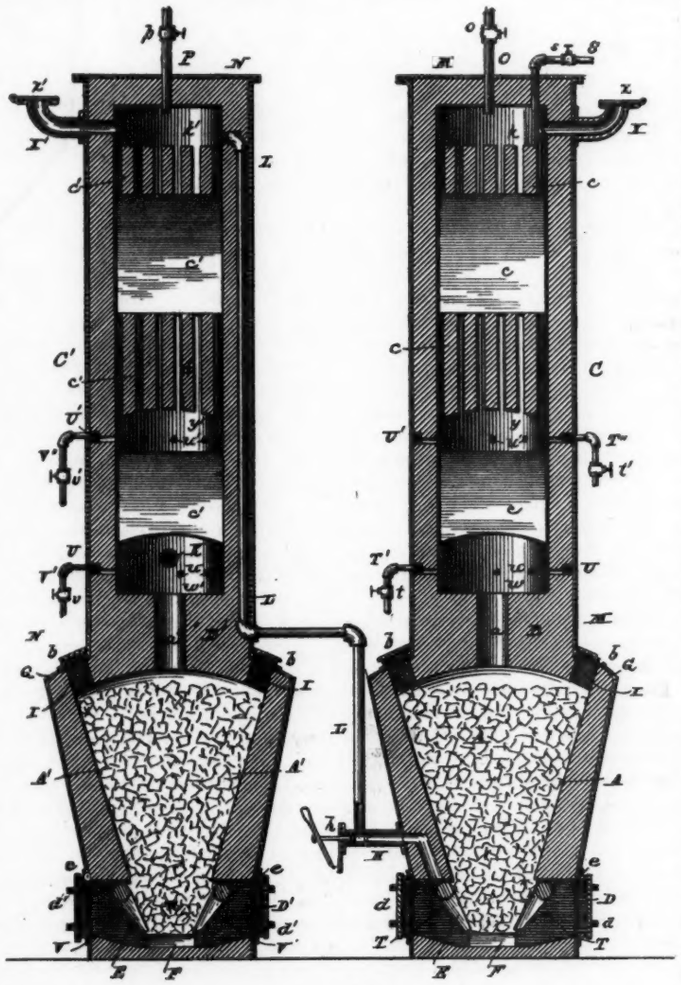
The object of the invention is to economically manufacture high grade illuminating gas by first producing low grade fuel gas, known as "producer gas," from cheap fuel—such as bituminous coal, slack, or other low-priced material—and, by means of such gas, heating up a combining and fixing chamber containing refractory material—such as firebrick—and then utilizing the heat stored in the refractory material for vaporizing hydrocarbon liquid and combining the vapors with water gas, and converting the mixture into a fixed illuminating gas.

While low grade fuel—such as bituminous coal or slack—can be advantageously used to make producer gas, which can be burned while hot to heat an oil vaporizing and gas fixing chamber, such fuel is not adapted for decomposing steam to make water gas, since it cakes and runs together under the high heat in such manner that steam will not pass through it, and, besides, it contains too large a percentage of sulphur and other impurities to yield a desirable quality of water gas. The present design, therefore, is to burn only that quantity of high priced, hard, anthracite coal or hard coke in the water gas generator which is required to heat such body of coal to incandescence, and heat the steam superheating chamber above, the waste gaseous products arising from the high grade coal or hard coke while blasting with air being utilized for heating such steam superheating chamber; and in order to properly heat the oil vaporizing and gas fixing chamber, to utilize the low grade cheap fuel heretofore mentioned. The hard coal or coke re-

quired for decomposing steam is adapted to be rapidly blasted with a strong air blast for quickly heating it to incandescence after it has been deadened by the passage of steam through it for decomposition, and one is thus enabled to quickly heat it up after a run for making water gas, though no more of such fuel is burned than is required for heating the steam superheating chamber. The inventors say they are, however, able to use with much economy low grade cheap fuel, which can only be burned slowly at a comparatively low temperature for heating the combining and fixing chamber, as such chamber is necessarily heated only to a moderate temperature, so that it will convert the hydrocarbons into fixed gas without burning them into lampblack. Moreover, such low grade fuel is not deadened by the passage of steam through it, and can, therefore, be kept alive and be gasified with slow combustion and at a comparatively low temperature. The invention includes the operations, as described, with both kinds or qualities of fuel, whereby greater economy is effected in the manufacture of illuminating gas.

Another object of the invention is to provide for more conveniently and evenly charging the fuel and decomposing chamber with fuel and clearing it of clinker which collects and adheres to the side walls.

The accompanying drawing illustrates a vertical section of a pair of improved cupola generating furnaces properly connected and arranged for carrying out this process of manufacturing illuminating gas.



The two cupola furnaces *M N* are constructed substantially alike, with slight differences in the connections of pipes for steam and gas, the right-hand cupola (lettered *M*) being arranged for superheating and decomposing steam to form water gas, and the one to the left (lettered *N*) being arranged to vaporize hydrocarbon oil and combine it with water gas to form a fixed illuminating gas. They are constructed with fuel chambers *A A'* at the base, and the steam superheating chamber *C* and the oil vaporizing and gas fixing chamber *C'* at the top, the upper and lower chambers being separated by arched brick partitions *B B'* having passages *a a'*. Chambers *C C'* are filled with refractory brick or tile *c c'*, preferably laid in high courses at right angles to each other. Combustion chambers *w w'* are provided immediately above the arches *B B'*, and secondary combustion chambers *y y'* are provided above between the courses of brick. These combustion chambers have annular air supply flues *U U'* and ports *u u'*. Air supply pipes *T T'*, having valves *t t'*, connect with the annular flues of chamber *C*, and air supply pipes *V V''*, having valves *v v'*, connect with the annular flues of chamber *C'*. Pipes *X X'*, having tight fitting lids *x x'* for the escape of products of combustion, connect with the tops of chambers *C C'*.

The fuel chambers *A A'* are of peculiar and improved construction. They are made to project laterally at the top beyond the vertical walls of the superheating and fixing chambers above. The top *G* of the projecting portion joins the main vertical walls of chambers *C C'* at or near the division arches *B B'*, and such top is provided with passages *I*, closed by tight lids *b b*, for feeding in the fuel at two or more points in the circumference, so that it may be evenly distributed, and for inserting clinkering bars to detach clinker adhering to the side walls down in the fuel chambers, and properly adjust the fire. The side walls are preferably made flaring from the base of the fuel chamber up to the top *G*, so that they may be effectually cleaned by bars inserted in the downwardly extending passages *I*. The fuel chambers extend at their lower ends *m n* down into the base chambers *D D'*, occupying the place of the usual ashpit. These chambers have each tight fitting doors *d* and *d'* on opposite sides of the furnace. The extension of the fuel chamber is formed by the brick side walls of chamber *D* and the inclined bars *E*, extending across chamber *D*. The top crossbars *e* of bars *E* are set in the brick walls a short distance below the top of chambers *D D'*, so as to leave spaces for inserting temporary false bars to support the body of fuel above when clearing the ashes and clinker from the extensions *m n* below. Base blocks *F*, of iron or brick, and which may be provided with passages on a line with doors *d d'*, rest upon the floors of chambers *D D'* for supporting the fuel. Air blast pipes *T V* connect with chambers *D D'*. At the top of chamber *C* connect steam supply pipe *S*, having valve *s*, and oil supply pipe *O*, having valve *o*. An oil or vapor supply pipe *P*, having valve *p*, connects with the top of the chamber *C'*. The gas take-off pipe *H* for water gas connects with chamber *D* of cupola *M*, passing a short distance through the walls of the fuel chamber, and is provided with a valve *h*. Gas pipe *L* connects with pipe *H*, and extends up through the brick wall of chamber *C'* in cupola *N*, and opens into the top of chamber *C'*, where it supplies hot water gas. The take-off pipe for illuminating gas leads from chamber *w'* in the base of chamber *C'*.

The operation is as follows: Fires are kindled in the fuel chambers *A A'* of cupolas *M M'*, and they are supplied with fuel until deep bodies of fuel are well ignited, the lids *x x'* being open. Air blasts are admitted to the bodies of fuel and also to chambers *w w'* and *y y'*, for burning the gaseous products arising from the fuel till chambers *C C'* and the contained brickwork are heated to the desired temperature for superheating steam and for vaporizing oil and converting it into a fixed gas with the water gas. Cheap fuel—such as bituminous coal or slack—is supplied to chamber *A'* so as to make what is known as "producer gas," which is of suitable quality for heating up the oil vaporizing and gas fixing chamber *C'*. Hard anthracite coal, or hard coke of high grade, is supplied to the steam decomposing chamber *A*, so as to make a good quality of water gas. The chambers *C C'* being properly heated and the body of fuel in chamber *A* being raised to incandescence, the air blasts are shut off, lids *x x'* are closed, valve *h* is opened, and steam is admitted by pipe *S* into chamber *C*, where it is highly superheated by passage down in contact with the heated brickwork. The superheated steam is decomposed into hydrogen and carbonic oxide by passage down through the incandescent fuel in chamber *A*, and these gases pass while hot through pipes *H L* into the top of chamber *C'*, into which, at the same time, hydrocarbon oil or vapor is admitted by pipe *P* in sufficient quantities to carburet the water gas and form illuminating gas of the desired candle power. The oil flows down over the heated brickwork into a gradually increasing temperature till it is all vaporized. The oil vapors are combined with the hot water gas, and in the hotter portions of the chamber *C'* are converted into a fixed illuminating gas, which flows off through the pipe *K*. At the time of admitting steam into chamber *C* a small supply of hydrocarbon oil is also admitted into such chamber in suitable quantity to supply one equivalent of carbon to two equivalents of oxygen in the steam, whereby mutual decomposition of the oil and steam will take place to form carbonic acid and hydrogen gases.

These gases, together with any remaining undecomposed steam, pass into the body of incandescent fuel, where the carbonic acid is converted into carbonic oxide and the steam is decomposed into hydrogen and carbonic oxide. The manufacture of gas is continued, as above described, till the temperature of the chambers is too much reduced for effective operation, when the steam and oil are shut off and the chambers *C C'* and body of fuel in chamber *A* are reheated, as above described, for again making gas.

In the operation of reheating the apparatus producer gas is again made in chamber *A'* and burned in chamber *C'* for heating it.

Mr. A. C. Humphreys' Paper on Water Gas, before the British Association.

At the Newcastle meeting of the British Association one of the features of the proceedings in Section G was a paper on "Water Gas," contributed by Mr. A. C. Humphreys, of Philadelphia, Pa., which, in the absence of the author, was read by General Webber. We give the following abstract of the paper, and also an epitome of the discussion:

The paper said that water gas is generally obtained from the decomposition of steam which has been brought into contact with incandescent carbon. The first reaction obtained is the formation of carbonic acid and the liberation of hydrogen. The carbonic acid is brought into contact with an additional quantity of incandescent carbon, from which it takes up an equivalent and becomes carbonic oxide, so that there results, theoretically, a mixture of hydrogen and carbonic oxide in equal volumes. These gases have no light-giving properties, so that if they are to be used for illuminating purposes, they have either to be mixed with some hydrocarbon in the gaseous form, or they must be employed to raise to a white heat some solid substance, such as lime, magnesia, platinum, etc. In 1874 there was practically no water gas made in the United States or in Canada. It is estimated that, at the present day, out of 1,150 gas works, 300 are on the water gas system. The author next proceeded to consider the theory of the process in detail, and calculated the distribution of heat throughout the reactions, remarking that it is only by the application of the water gas system of manufacture that the whole of the carbon used can be converted into gas. In conclusion, the author expressed his belief that the day of gas—fuel gas—was rapidly approaching, and that fuel gas must mean, in part, water gas. Even the great rival of gas, the electric light, might yet be dependent upon it for the cheapest means of producing the electric current; and the gas engineer and the electrical engineer would be striving to correct the present wasteful strains upon nature's storehouses.

Sir I. Lowthian Bell said he took entire exception to the statement that the day of fuel gas was rapidly approaching. A greater philosophical fallacy could scarcely be pronounced, so far as heat was concerned; the cheapest and most efficacious form in which they could get heat was by putting coal into the fireplace where they wanted to use it, without making water gas or any other kind of gas, except that given off at the moment of combustion. Out of 100 parts of coal, 83 per cent. was utilized by burning, by water gas 78 per cent., and by producer gas 71 per cent. He entirely disbelieved that anything could be gained from a calorific point of view by converting fuel into water gas. That on many occasions a fuel could be obtained which might be well worth the extra expense (but that was in a very limited way) for effecting certain objects, he was not prepared to deny; but he entirely dissented from the statement that they were going to abandon solid fuel and economically substitute in its place gaseous fuel.

The next speaker was General Webber, who remarked that great progress had been made with this gas in the United States, but little in Europe. This was chiefly due to the high cost of ordinary gas in America. What was known in this country as Dowson gas was made before Mr. Dowson had any connection with the subject. He, the speaker, was responsible for the name. Water gas had got so bad a character in Germany that they determined to rename it, and the title of "Dowson gas" was adopted. Nitrogen was in Dowson gas because it was useful for gas engine purposes. If the gas were required for burning or heating, another plan would be followed.

Mr. A. E. Fletcher referred to the important fact in connection with this subject that Mr. Mond, in his process of producing gas, saves the ammonia, and this exceeds in value the coal used. It would be well for Sir Lowthian Bell to bear this in mind when considering the subject. The effect would not only be to cheapen the gas, but to introduce an agricultural product much wanted. Sixty-six pounds of ammonia sulphate would be produced by a ton of coal. This was more than double the ordinary gas works product. It might come even to this that the gas would be simply a bye-product instead of being the only object in the consumption of the fuel. The collateral advantages also must not be forgotten, amongst which the absence of smoke might be classed. We think Mr. Fletcher might have pushed his argument further; that the gas, ammonia, and all other substances should be considered bye-products, the chief gain being this absence of smoke, which is by no means a noticeable feature in a certain district not more than 100 miles from the Clarence chimneys. Nothing could be more deplorable than the havoc created by the fume fiend in the neighborhood of Newcastle. Trees are mere stunted skeletons, hedgerows leafless, and all vegetation is seared with the blight poured from foul smokestacks.

The President, in moving a vote of thanks to the author, pointed out the great pains that must have been taken in getting together the information in the paper. There was a good deal in it that was more suitable for the Chemical Section, but it had been grouped with the transmission of power papers and had so come into Section G.

Preventing the Thickening of Tar in the Hydraulic Main.

The London *Journal*, in noticing that Herr Langen (Germany) has devised a system of preventing the thickening of tar in the hydraulic main, explains that the author has previously drawn attention to the fact that the seal in the hydraulic main produces considerable variations of pressure in the retort. The gas first drives out the liquor in the dip-pipe, and then forms a large bubble at the mouth of the pipe, the pressure in the retort being thereby increased. As soon as the bubble has attained a certain size it rises to the surface, forming temporarily an open channel between the retort and the hydraulic main, so that the pressure in the retort is again diminished. Eventually the liquor again rises in the dip-pipe, and the whole process is repeated. Distillation takes place therefore under a pressure which varies constantly between *nil* and a maximum, the latter being generally considerably greater than that due to the seal alone. Diminished production and partial decomposition of the heavier hydrocarbons result. The carbon thus produced is partly deposited as carbon on the walls of the retort, and partly in the ascension pipe. During the rise of the liquor in the dip-pipe the gas either ceases to move, or there is a backward movement favoring the accumulation of tar and carbon in the ascension-pipe. The area of the latter is consequently diminished, causing a further increase of pressure in the retort; and greater decomposition of the heavier hydrocarbons. Some of the carbon also collects on the interior of the dip-pipe, diminishing the area, and causing increased pressure. The remainder of the carbon mixes with the tar in the hydraulic main, making it much denser, and the heavier particles sink to the bottom, where they gradually accumulate and may ultimately reach the mouth of the dip-pipe.

In order to distribute the gas over a much larger surface of the liquor in the hydraulic main, the author recommends the following arrangement: The dip pipes are not cast in one piece with the bridge or H pipe, but hang vertically in the hydraulic main, on to the cover of which they are fastened with screw bolts. They are 25 centimeters in internal diameter, 80 in circumference, and 4.9 square decimeters in area; whereas those usually employed at the present time are 12.5 centimeters in internal diameter, equal to an area of 1.22 square decimeters. The equal-limbed bridge pipe is provided with two self-closing eccentric pressure covers for cleaning purposes. It is, on the average, 15 centimeters in internal diameter; the connecting pipe being generally even larger. By this arrangement the pipes have all the same dip, and their area is increased fourfold; so that only one-fourth of the gas produced comes into contact with a given surface of the liquor, and the surface of gas exposed to washing is double what it was before. The variation of pressure in the retort is in this way considerably diminished.

The thick tar can be readily removed during working by an arrangement which can be easily adapted to any existing hydraulic main. At one end of the main the cover is removed, and a small tank of the same shape as the main is screwed on with bolts. The tank is open above, and is in direct connection with the tar by means of an opening below. A screw is placed longitudinally at the bottom of the main, and rests in thrust-blocks placed at opposite ends of the tank. Its axis projects into the tank, and is there connected with a driving-wheel by means of bevel gearing. It is also provided with a chain and bucket arrangement—the number of the buckets being regulated according to circumstances; and in this way the tar is emptied into a small tank, from which it runs directly by a large inclined pipe to the tar well. The machinery is worked at stated intervals by hand, or continually by steam power, and the thick tar is thus removed as fast as it is formed, so that only liquor and light tar remain in the hydraulic main. With this arrangement the level in the main can be kept constant, or the seal can be entirely taken off during carbonizing.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

IT is the fashion or custom—as is the case in most other well-regulated communities—in Oakland, Cal., that when an individual desires the authorities to perform some act whereby the petitioner and the public generally are to be benefited, a petition is handed in to the ruling powers. Not long since a resident occupying a certain house in Oakland thought that the conditions of his premises would be bettered were an arc lamp substituted for the gas lamp then doing duty in the vicinity. He accordingly submitted a petition for the substitution, and concluded his argument in the following terms: "By so doing the electric light will do away with three gas lamps. There is a number of bad boys that assembles on this corner, and the aforesaid light would do away with a good deal of bad morals." When this petitioner has that light installed he might further better his condition by a short attendance at night school.

NEW York capitalists—represented by Mr. S. B. McConnel—are said to be negotiating for the purchase of the gas works at Brunswick, Ga. This could be made a very profitable field for gas suppliers.

WE understand that the St. Paul (Minn.) capitalists who are constructing the gas works at West Superior, Wis., have also acquired control in the Superior Water Works Company and in the local electric light company as well.

THOSE who have had occasion to clean old or worn out paint from woodwork know that the method of burning or scraping is tedious and laborious, and can never be accomplished with complete satisfaction. A correspondent claims to have tried the following method, which he says has always answered satisfactorily with him. The practice is to use a solution of quicklime and soda in equal parts. The soda is dissolved in water, the lime is then added, and the solution is ready for application to the purpose desired. An old brush answers nicely to spread the "remover," and the cleaned woodwork should then be washed off with hot water.

SOME time ago we noted the appointment by the City Council of Appleton, Wis., of a special committee instructed to visit Jackson, Mich., for the purpose of investigating the merits of the fuel gas there being sold for heating and lighting purposes—this action was taken by Council because of the application to it of certain parties for the right to operate a fuel gas works in Appleton. The committee having completed the investigation, now sends in the following report: "Your committee to whom was referred the matter of investigation and reporting on the gas proposed to be furnished by the persons now asking the Council to pass an ordinance granting them the right of way over the streets and alleys of said city to lay pipes for distributing said gas, would respectfully report that, in pursuance to direction, your committee visited the home office of said Company (in Chicago) and there found the light on exhibition in a small way and under favorable circumstances. After making as thorough an examination as the limited plant there on exhibition would admit of, your committee visited Jackson, Mich., where quite an extensive plant has been in operation for over a year. We found substantial buildings and what appeared to your committee a thoroughly equipped and well managed institution. Owing to the limited time at the disposal of your committee, the investigation was necessarily confined to the business portions of the city, where we found the gas had superseded other lights to an extent equal probably to one-half the lights used—there being two electric light companies and one other gas company in the city. We interviewed a number of persons who were using the gas both for light and fuel, and found the universal verdict to be that the gas furnished for 40 cents per 1,000 cubic feet for illuminating gas and 30 cents per 1,000 for fuel gas was, for lighting about one-third and for fuel about one-half the amount that any other light or fuel cost them. The gas was free from smoke, and the heat thrown off was about equal to that from an ordinary gas jet. The gas as furnished is not an illuminating gas, the light being furnished by a peculiar burner, which is provided by the Company free of cost to the consumer, and which the Company claims will last 100 hours each; but your committee are of opinion that said burner will gum up after about 20 hours' use, and thereby cause the light to be of a dull red color. The light given off by a new burner is of an intensely white color, very penetrating, absolutely without any flickering and soft to the eye. Your committee failed to find any serious objections to the use of said gas, and while we have no recommendations to make, we are of the opinion that the parties are capable of performing what they promise." This is rather a queer presentation to make, and the concluding sentence seems to vitiate whatever praise or credit is given by the committee to the process in use at Jackson. Fairness would seem to be served were the committee to come out bluntly and recommend that the Appleton fuel gas franchise would be a good thing for that place in view of the fact that they (the committee) are "of the opinion that the parties are capable of performing what they promise;" for certainly, the promoters of the Appleton scheme promised enough in all conscience. From all that we can learn (and we have striven to be perfectly fair in arriving at a conclusion) we are afraid that the Jackson water gas, used for illumination through the converting medium of a Fahnehjelm comb burner, is far from being a success.

ARTICLES of incorporation of the Faribault (Minn.) Consolidated Gas and Electric Light Company have been filed. The incorporators are: Messrs. Edward R. Gilman, Wilford G. de Celle, Hayden S. Cole, Geo. C. Duffie and Henry W. Turner, all of St. Paul, Minn. The capital stock is $100,000.

SECRETARY VANSANT, of the Morris & Tasker Company, thinks that the business outlook is of the best possible sort, although he is not inclined to assert that we are to have a "boom" within the next year or so in the department of gas works construction. At the Company's plants at Philadelphia and New Castle about 1,400 hands are employed.

THE Fayette Fuel Gas Company, which has a monopoly of the right to distribute natural gas in the Uniontown (Pa.) district, have just made public a new schedule of rates, the same to take effect from the first inst. Under the schedule consumers are called upon to pay $1.25 per month for a cook stove, 75 cents per month for the first grate, 60 cents for the second grate, and 50 cents for each additional grate. These rates have caused much grumbling, since they show a large advance over the last schedule, and in fact are not far behind the cost of solid fuel. Under the old schedule one cook stove and four grates could be maintained at a cost of $22 per year, whereas now a similar service will cost $43.20. An advance of 100 per cent. ought to cause grumbling.

THE Putnam (Conn.) Power and Light Company is making a vigorous effort to popularize the use of gas for cooking and heating, and so far has met with fairly good success in the effort.

A MOVEMENT is going on in Philadelphia Councils for the restriction of the sale of gasoline in that city. At a recent session of the Committee on Police and Prisons the matter was discussed in a spirited way, with the result that Messrs. Kenton, Harris and Grace were appointed a committee to wait on the Mayor to urge his attention to the necessity of enforcing the laws in respect to its sale. During the discussion some very pointed remarks were made by Mr. Beasley, who, among other things, said: "To sell gasoline for use as an illuminator in this city is positively illegal—a direct violation of the plain and unmistakable meaning conveyed by the language of the act of 1874. Despite this the lives of hundreds of citizens are hourly imperilled by a danger that wise legislation has thrown safeguards about. If gasoline were able to submit to a fire test of 110° F., as required by law, there would be no hindrance to its sale, but the fact is that it is a fluid so volatile that it is not amenable to any fire test. For the enforcement of the law I think the Department of Public Safety is responsible. It is the duty of the ruling spirit of that department to see that it is enforced. If further words were required, gentlemen, to prove to you the urgent necessity for giving heed to this knock of danger upon our doors I would mention the fact that the authorities encourage citizens to violate the law by setting up illegally throughout the city over 7,000 gasoline lamps."

THE New York Central and Hudson River Railroad will light the Controller's offices, in the depot building on 42d street, this city, by means of 40 Lungren lamps.

IT is reported that the works and franchise of the Uniontown (Pa.) Gas Company have been purchased by J. K. Ewing, Jr., on behalf of a syndicate headed by Robert L. Brownfield, of Philadelphia.

MR. C. D. STRONG, formerly with the Columbus (O.) Gas Light Company, has been appointed Superintendent of the Nebraska City (Neb.) Gas Light Company.

SOME time ago we noted the incorporation of the Fort Scott (Kans.) Light and Fuel Company, but supposed that its formation was for the purpose of taking over the plant and property of the Fort Scott City Gas Company, owned or controlled by Mr. L. K. Schofield. It seems, however, that Mr. Schofield concluded not to dispose of his property, and

the new incorporation at once took measures to go actively into business. At a meeting of the Company (held Sept. 25) the following organization was affected: President and General Manager, W. H. Frost, N. Y.; Vice-President, H. C. Moore; Secretary and Treasurer, George P. Knapp; Directors, G. M. Porter, C. W. Isbell and W. H. Frost, of New York; Frank Playter, Pittsburg, Kans.; and H. C. Moore, J. D. Hill and Geo. P. Knapp, of Fort Scott. Mr. Frost was instructed to go ahead with construction work, and the contract for the erection of the buildings has since been awarded to George Goodlander, of Fort Scott. The contracts for machinery have also been let. Coal gas is to be made.

NOT long since we noted that the authorities at Montreal, Canada, wishing to add to the effectiveness of the arc lighting of the city, asked the Montreal Gas Company to agree to maintain 700 gas lamps on the basis of a payment therefor of $15 per lamp per annum. We intimated that this proposition would not be agreed to by the Gas Company, and this view is now confirmed by the action of the latter in submitting its willingness to take up the work on the basis of $17.50 per lamp.

THE Maine Fuel Company has been organized, at Saco, Me., with a capital of $200,000. Its officers are: President, Jno. H. Roberts, Chelsea, Mass.; Treasurer, W. H. Harris, Watertown, Dak. According to the articles filed the business to be prosecuted is the manufacture and sale of gas.

THE improvements on the Sioux City (Iowa) Gas Company's plant are in a forward state. The water gas annex will be completed in time for use this winter.

SECRETARY WINDOM has discovered the fact that a combination exists between the manufacturers of gas and electric light fixtures—most other people were aware of this fact months ago. In any event, the Secretary had occasion last summer to advertise for bids for the supply of gas and electric light fixtures to several public buildings now in course of erection in various parts of the country, and when the tenders were opened he was surprised at the singular unanimity of the figures submitted, and by the further fact that the figures were from 20 to 40 per cent. above those last handed in to the Treasury on account of similar furnishings. In all probability the tenders will be rejected.

THE Illuminating Fuel Gas and Lime Company has been incorporated, at Chicago, by Messrs. Jas. A. Tracey, Chas. A. Van Duyn and N. H. Hanchett. It is capitalized in the modest sum of five millions.

MR. B. F. Africa, lessee of the Huntingdon (Pa.) Gas Company, has agreed to put in an electric light plant for the purpose of furnishing the borough with arc lamps. Two propositions for the lighting were submitted. Under the first he agreed to furnish 20 arcs, to run each night and all night, at the rate of $100 per annum each, or to furnish 30 arcs (to run until midnight), on the basis of $60 each. The latter proposition was accepted. The electric plant will be installed at once. It is to be of the Thomson-Houston type, mixed system.

THAT curious scheme for the construction and operation of a municipal gas works in St. Louis will again occupy the attention of St. Louis Councils some time this month. Beyond a doubt it will be emphatically negatived—as it ought to be.

THE Portland (O.) Gas Light Company has made important extensions to its main system this summer.

A CORRESPONDENT informs us that Mr. Lucius Frierson has sold a controlling interest in the Columbia (Tenn.) gas and water works to the Columbia Improvement Company, an organization dominated by Messrs. George Childress and F. J. Ewing. It is also understood that the electric light works will pass into the same hands.

GOSHEN, N.Y., is soon to be lighted by means of incandescent electric lamps, the authorities having awarded a contract for the maintenance of 100 such (20-candle power, to burn each night and all night) on the basis of a total payment per year of $2,500.

IN our mention of the sale of the Uniontown (Pa.) gas works to Jno. K. Ewing, Jr., it should also have been said that the sale was made to settle up the estate of the former owner—the late Ebenezer Robinson.

THE survey for a canal, between Liverpool and Birmingham, has just been completed, and estimates of the probable cost prepared. The scheme is to construct a canal through Staffordshire, uniting with the Weaver Navigation at Winsford. The canal is to have a breadth of 72 feet, and will be navigable for vessels of 500 tons. Hydraulic lifts will be used instead of locks. The length between Winsford and Birmingham will be 64 miles, and the whole length of the watercourse 104 miles. The expense of construction is put at $12,500,000.

THE President of the village of Greenbush, N. Y., has vetoed the resolution of the Trustees awarding the public lighting of the village streets to the East Albany Gas Light Company, for a term of 5 years. He objected to the length of the contract. At the meeting of the Trustees at which the veto was read, it was then resolved to award the contract to the same Company, but to limit the time to 2 years. The work is to be performed by means of 175 incandescent lamps, of 25-candle power each (moon-table), the payment therefor to be at the rate of $3,200 per annum.

"WALLA WALLA, Washington, is one of the progressive cities of the Great West, with a population of upwards of 6,000, and, while not afflicted with the modern 'boom,' is enjoying a constant, healthy growth. The gas and electric interests are well represented; the first having been established in 1881, and the latter as an arc lighting system about one year ago—the Gas Company having taken half the stock of the electric company. The Walla Walla Gas and Electric Company has now been incorporated—consolidating the interests—and will make extensive additions for incandescent lights and for motors. The steam plant will consist of high-speed compound condensing engines and water-tube safety boilers, aggregating at first 165-horse power. The capital is $100,000. As both the old Companies have been paying monthly dividends, it is expected that the stock will pay from the start.—O. B."

AT a special meeting of the Jeffersonville (Ind.) City Council the business for consideration was the public lighting contract. The special committee that had been looking over the proposals reported in favor of awarding the contract to the Jeffersonville Electric Lighting, Gas Heating and Illuminating Company for a period of 10 years, to furnish 45 lights (arcs, 2,000-candle power), at $90 per annum for each, the lights to burn every night until 1 A.M. All lights over the 45 are to be paid for at the rate of $85 each per year. The report of the committee was concurred in and the contract so awarded. In the meantime it might be remarked that a proposition submitted by the Jeffersonville Electric Light Company called for the payment of $75 per lamp for a like service.

SUIT for $50,000 has been brought against the Fort Wayne (Ind.) Jenny Electric Light Company, which about two years ago agreed to maintain an arc light plant in Plymouth, Ind., if the citizens there would subscribe $110,000. Fifty thousand dollars was raised and used to build the factory. The subscribers then asked the Company to show by its books that its stock was worth as much as was represented. This the Company refused to do, and as the rest of the money was not paid over the Plymouth factory was abandoned and is now lying idle. This suit is brought to recover the money expended in building the shops.

THE St. Paul Chamber of Commerce is still struggling with the figure at which it would request the local Gas Company to sell its gas. At the last meeting of the body it was decided "That the price should not exceed $1.50 per thousand, and be uniform to all consumers at that price in order that all citizens may share alike, in proportion to the gas they burn, in the benefits of the franchise granted by the city." This proposition was quite warmly debated, and the discussion ended in laying the whole matter on the table, where it is likely to remain for some time.

BUFFALO, N. Y., public lighting contracts expired on the first inst. It is said that a determined effort will be made to curtail the number of arcs used, on the ground of their expensiveness.

PRESIDENT VAN STEENBERGH has not as yet succeeded in disposing of his holdings in the Macon (Ga.) Gas and Water Company to English capitalists.

WORK on the plant of the Metropolitan Gas Company, Elizabeth, N. J., is progressing.

THE annual meeting of the Edgewater Light Company will be held in Chicago to-day.

MESSRS. TREWBY AND WOODALL, the celebrated English gas engineers who are now in this country investigating the manufacture and distribution of water gas, inspected the works at St. Louis, Mo., in the last week of September. They were accompanied by Mr. G. S. Page. We wonder if the latter persuader could prevail upon these gentlemen to stay over until the close of the Baltimore meeting?

It is reported that capitalists are anxious to secure control of the gas and water works systems of Augusta, Ga., and that negotiations to this effect are under way. In the absence of definite information to the contrary, we are inclined to think that these Augusta properties are worth as much to the present owner as to anybody else, and that they are likely to remain under the present proprietorship for quite a while.

The following, from President McMillin, of the Laclede Gas Light Company, will be read with interest: "Work is going forward steadily on the electric plant being installed for the Laclede. I have several propositions now awaiting investigation for work to be done, and contracts for certain portions of the electric plant will be awarded shortly. Nothing new has developed in the attitude of the outstanding stockholders of the St. Louis Gas Light Company, nor is any action expected by us before January 1, at which time the old charter expires and the consolidation of the Companies will be perfected. As to what steps will be taken in finally winding up its affairs, I cannot definitely state, and I suppose the laws provide for such action. I had thought that the charter itself specified what was to be done at its termination, but I find I was mistaken. There is a difference of opinion as to the value of the 30-year franchise of the St. Louis Company, beginning next January. The old stockholders believe it is a very valuable privilege, but the Laclede people are not fully convinced as to its value. Of course, if the franchise is good, it is that much better for us, as we own ⅓ of the stock, but we do not propose to work under it. That franchise provides that not over $1.18 per 1,000 shall be charged for gas, which is the net price of $1.25 per 1,000. This is the figure which the Laclede proposes to charge for gas after January 1, 1890, so that cheap gas is a foregone conclusion any way. We cannot make the reduction before that time, but it has been decided to do so then."

The City Council of Halifax, N. S., has appointed a committee for the purpose of inquiring into the advisability of engaging the authorities in the operation of a municipal electric lighting station. It is not intended, in case such a course should be decided upon, to supply electricity for any other object than the illumination of the streets and public buildings. If Halifax is wise, her voters will permit this service to be carried on by private enterprise.

Some months ago a certain Florentine H. Heistler, residing at No. 1,824 Croskey street, Philadelphia, made up his mind that his gas bills were too large. In order that they might be brought within reasonable limits he bye-passed the meter, with the result that when the inspector made his usual examination of the dial he was quite surprised at the small quantity of gas that Heistler had used in the interval of the last inspection. The inspector found the bye-pass, and asked for an explanation. Heistler said it (the pipe) was put there for electrical purposes. His arrest and conviction speedily followed the "explanation." The penalty paid was $50 and costs.

Commissioner Purdy says that he cannot interfere in any way to prevent the construction of the Mutual Fuel Gas Company's works on Ellis avenue, Hyde Park district of Chicago, a remonstrance against which by certain residents of the neighborhood was printed in our issue of September 23. The reason for this inability to interfere is that the necessary permit was granted by the Trustees of Hyde Park before the latter place was annexed to Chicago.

One of the features of this year's gathering on the grounds of the Worcester North Agricultural Society, which we believe are in the vicinity of Fitchburg, Mass., was a marriage ceremony, the initial trip of the happy pair then to be taken in a balloon that was to ascend from "the midst of the spectators" who visited the "show" either for the purpose of gazing on fat cattle or beholding what should be a solemn ceremony turned into a catchpenny attraction. In the meantime it was necessary that the balloon should be filled with gas in order that the wedding trip farce should be enacted, and "Prof." Allen—who is not to be in any sense confounded with the aeronautic house of Jas. Allen & Sons, of Providence, R. I.—applied to Manager Coggshall, of the Fitchburg Gas Company, to inflate the air-ship on a certain date, the gas to be taken from a certain point. He (the Supt.) was told that the balloon would absorb about 47,000 cubic feet of gas, and a contract for that quantity of gas was entered into, Allen fixing the day and hour when the balloon would be in readiness for filling. Through some mismanagement of the aeronaut—the gas was to be fed in from a 3-inch main at a point 3,000 feet distant from the gas works—the valve connection was not made in time to allow for the complete inflation at the hour in which the balloon's services were to be required. The result was that the newly-wedded pair were unable to make the skyward trip, much to the regret of the visitors to the Fair from the "back counties." "Prof." Allen, of course, must charge the failure to someone else's score, and accordingly selected the Gas Company, whose representatives were freely charged with inability to "determine the rate of flow of gas through pipes." The comments on this head in the newspapers were so unfair that Manager Coggshall decided to make a statement regarding the case, and this is the way that he chose to do it: "To the Editor of the *Evening Mail:* My attention was called to a severe criticism in your paper of September 26th, reflecting upon the Fitchburg Gas Company, of which I am Manager, on account of the failure to fill the balloon for the Fair on time. Let the blame rest where it belongs. That the public may form an intelligent opinion upon whom the blame should rest I will state that the law governing the discharge of gas under a given pressure, through 6-inch and 3-inch mains, is as follows: A 6-inch main will deliver 18,000 feet through 300 feet length of pipe per hour, and will deliver through 3,000 feet in length only 5,800 feet per hour; while a 3-inch pipe would deliver 3,500 feet through 300 feet in length, and would deliver through 3,000 feet only 1,000 feet per hour—the above is based on 1-inch pressure. Mr. Allen stated that he had filled the same balloon in Boston through a 6-inch main in three hours—bear in mind that the pressure in Boston is much greater than in this city. The place selected by them required the passage of gas through 3,000 feet of mains. Mr. Allen and Mr. Ogden say that I said I could fill this same balloon in three hours at the point selected, which required the passage through a 3-inch main part of the distance. I say I did not agree to fill the balloon at this point at any given time; the question was not asked me. I did say that I would have sufficient gas on hand to fill the balloon. As a matter of fact I did have 75,000 feet in the holders on Tuesday and Wednesday mornings, as our books of record will show, so that Mr. Allen had ample time to have had the balloon filled at the time specified, namely, 2 o'clock Wednesday. Does any sane man for a moment believe that I said I could fill the same balloon in three hours through a 3 inch main, 3,000 feet from the works, when it required 3 hours to fill the same balloon through a 6-inch main in Boston? Now, what are the rules governing conflicting evidence? I answer, common sense and motive. A great mistake has been made. All I have to say to the intelligent people of Fitchburg is that not one iota of blame rests upon Mr. Ogden or any other officer of the Society. It rests upon either myself or Mr. Allen, and can only say, use your good common sense and judge for yourselves, and I will abide by the result.—H. F. Coggshall."

The fraternity will learn with sorrow of the death (on Wednesday last) of Mr. Charles C. Mowton, of the Consolidated Gas Company, this city. The interment was made last Saturday from the Church of the Beloved Disciple. We hope in due course to print a suitable obituary notice of deceased.

An explosion occurred on the evening of Wednesday, Sept. 26th, in the electrical annex of the Valparaiso (Ind.) Gas Light Company. The theory of the explosion is that gas had accumulated under the floor of the dynamo room, from an exterior storage tank for naphtha, and the vapors were fired from contact with the furnaces in the engine room. Manager Stratton intends to change the practice of storing naphtha in vogue at Valparaiso. The damage was trifling.

American Workmen back from Europe.

Some weeks ago we chronicled the departure from this country to Europe of a body of workmen, which trip was taken for the purpose of confronting the voyagers with the conditions and practice that obtain in European channels of skilled labor. This party, says the *Scientific American*, got back to New York on September 12th, and on the question of the comparative productiveness of the American and foreign workman they were in a unit in support of the superiority of the former. This, they held, was partly because the American worked harder and for longer hours and with fewer holidays than the foreigner, but mostly because of the vast superiority of the American machinery.

A. T. Anderson, the tinsmith of the party, said: "I saw a remarkable exemplification of this fact in Liverpool, where I saw the leading tinsmithing establishment at work turning out a buoy. They were stamping out some half spheres, and it took them nine processes to accomplish a result that is reached in our stamping works in three processes."

William Hanna, a Cleveland, O., iron worker, said: "I am not exaggerating when I say that if I had in a mill in Cleveland the plant which I saw in operation in a mill in Glasgow, Scotland, I would break that plant up for scrap iron. We tried to get into Cammell's and Brown's

works in Sheffield, but they would not let us in. The condition of workmen in my line abroad I found to be decidedly inferior to what it is in this country."

Mr. Cheney, the miller of the party, who is employed in the monster Washburn mill at Minneapolis, said: "At the Paris exposition the foreigners displayed with great pride their lay-out of milling machinery. It was very pretty and bright, but they did not seem to think so much of it when I told them that what they were exhibiting as the latest milling devices I had just taken out of our Minneapolis mill and replaced with improved machinery. Their machinery is too slow. We beat them in swiftness of work every time."

Mr. Ogden, who represented the American printers, said that he found the mechanical part of the printing business in Europe just where he had found it in this country when he learned his trade 22 years ago. "The quick men of their composing rooms," he said, "are not up to our slow men. Their stereotypers do quick work. Those who do the work for the 'favorite editions' of the London afternoon dailies, which often run up to 110,000 to 120,000 copies, are as quick as our stereotypers, but their work is not so good, and these papers have a ragged appearance that would not be tolerated here. The composing rooms lack comfort, are poorly lighted, and are unhealthy."

"The impress of the American inventor is nowhere more marked abroad than in their shoemaking machinery," said Hugh Cavanaugh, a shoemaker from Cincinnati. "There is a strong indisposition on the part of manufacturers to use improved machinery, and such machinery as they employ is based on American ideas. A workman there, however, is not expected to do more than 65 to 75 per cent. of what an American workman accomplishes. There seems to be no desire to test man and machine to their full capacity. It really costs more money there to make as good a shoe as is made here, but instead of thus producing better machinery in order to produce better shoes, the people are satisfied with the poorer product. With the exception of one or two factories in Paris, none of the foreign makers turns out a shoe that has any pretension to style. The workmen take life easily. They work 54 hours in the week and have lots of holidays. They are well organized and are looking forward to bringing down the hours of labor to 8 per day. Rents are far cheaper there than here. The President of the Leicester (England) shoemakers' union lives in a comfortable six-room house for which he pays 6s.—about $1.50—a month. There are 30,000 shoemakers in Leicester, and the general run of them have snug quarters of from four to six rooms each."

Mrs. Barry, who is familiar with the condition of working women in this country, who made a thorough investigation of how they fare abroad, said: "The condition of women who work in Europe is in many instances deplorable. There is much fault to be found in America, but with a single exception the working woman of a given kind in America is better off in every respect than her sister abroad. The exception I allude to is the woman engaged in clerical work. In England she works from 10 in the morning till 5 in the evening. In America she begins at 8 in the morning and ends at 5. But women's pay in every branch of industry in this country is better than in Europe, and it will cost a woman in Europe far more money than it does an American woman to live in the same comfort that the latter does. In the "Black Country" of Devonshire, England, I saw women at the anvil making nails and chains, swinging the hammer with a vigor that would shame some men. In many iron foundries I found women performing men's work, and some of them so engaged were over 60 years of age, and had been at it all their lives. The seamstress in this country is, bad as her condition is made by the imported shop system, better off than her sister abroad. Women there make shirts with hand needlework for 18 cents apiece, and with the machine for 30 cents per dozen. The women who make nails and chains at the anvil get 36 cents a day."

Joseph Thorpe, an engineer from Murfreesborough, Ill., said that he had talked to several of the oldest engineers in England, and found them all anxious to come to America, but all declaring that they could not save enough money from their small wages to bring them here. Taey had for years been trying to have the American locomotive cab for the engineer and driver introduced on English roads, but as a reply to their importunities their employers have taken away their wooden seats, urging as a reason that there is less chance for a man to go to sleep while standing than while sitting. They were, however, working hard to effect an organization of the engineers, firemen, guards, (brakemen), signalmen, and switchmen, and hoped that their condition would be improved soon after it was accomplished.

William Delaney, a bricklayer, said: "I saw no work in my line on the other side which compares with the work done in America. Wages are lower there." William T. Lewis, president of the miners' organization, said: "Wages are low abroad as compared with wages here, but the work is steadier. On the whole, I think we are better off."

Edmund M. Vail, a blacksmith, thought that men of his craft in this country were doing better than those he saw in Europe. The blacksmiths abroad whom he found best off were those in Glasgow. Those in Germany, France, and Holland were far behind their English brethren.

All in the party were agreed that they had had a jolly time of it. They had been welcomed everywhere. In England they failed to run foul of the reported insular prejudice, and were entertained by members of Parliament, a live marquis—him of Ripon—and several other high dignitaries. Not one of the party had gone astray; but all were agreed that if fifty foreign workingmen were to come here on an expedition of study, very few of them would make the return trip.

Valuable Instructions for Engineers.

The Eclipse Pump Manufacturing Company, Cincinnati, publishes the following instructions to engineers:

1. *Condition of the Water.*—The first duty of an engineer, when he enters the boiler room in the morning, is to ascertain how many gauges of water there are in his boiler. Never unbank or replenish the fires until this is done. Accidents have occurred, and many boilers have been entirely ruined, from neglect of this precaution.

2. *Low Water.*—In case of low water, immediately cover the fire with ashes, or, if no ashes are at hand, use fresh coal. Do not turn on the feed under the circumstances, nor tamper with or open the safety valve. Leave the steam outlets as they are.

3. *In Case of Foaming.*—Close the throttle and keep it closed long enough to show the true level of the water. If that level is sufficiently high, feeding and blowing will usually suffice to correct the evil. In case of violent foaming, caused by dirty water or change from salt to fresh, or *vice versa*, in addition to the action above stated, check draught and cover fire with fresh coal.

4. *Leaks.*—When leaks are discovered they should be repaired as soon as possible.

5. *Blowing Off.*—Blow down under a pressure not exceeding 20 pounds, at least once in two weeks—every Saturday night would be better. In case the feed becomes muddy, blow out 6 or 8 inches every day. Where surface blow-cocks are used they should be often opened for a few moments at a time.

6. *Filling Up the Boiler.*—After blowing down, allow the boiler to become cool before filling again. Cold water pumped into hot boilers is very injurious from sudden contraction.

7. *Exterior of Boiler.*—Care should be taken that no water comes in contact with the exterior of the boiler, either from leaky joints or other causes.

8. *Removing Deposit and Sediment.*—In tubular boilers the handholes should be often opened, and all collections removed from over the fire. Also, when boilers are fed in front and blow off through the same pipe, the collection of mud or sediment in the rear end should be often removed.

9. *Safety Valves.*—Raise the safety valves cautiously and frequently, as they are liable to become fast in their seats and useless for the purpose intended.

10. *Safety Valves and Pressure Gauge.*—Should the gauge at any time indicate the limit of pressure allowed by the inspector, see that the safety valves are blowing off. In case of difference, notify the inspector.

11. *Gauge Cocks, Glass Gauges.*—Keep gauge cocks clear and in constant use. Glass gauges should not be relied on altogether.

12. *Blisters.*—When a blister appears, there should be no delay in having it carefully examined and trimmed, or patched, as the case may require.

13. *Clean Sheets.*—Particular care should be taken to keep sheets and parts of boilers exposed to the fire perfectly clean; also, all tubes, flues, and connections well swept. This is particularly necessary where wood or soft coal is used as fuel.

14. *General Care of Boilers and Connections.*—Under all circumstances keep the gauges, cocks, etc., clean and in good order, and things generally in and about the engine and boiler room in a neat condition.

The Market for Gas Securities.

During the week the most pronounced dullness prevailed in the market, the reason therefor no doubt being the high rates for money, borrowers in some cases having to pay at the rate of 30 per cent. for accommodation. Despite this Consolidated held its own, being bid for to-day (Friday) at 88¼. The outside market is also featureless, unless it be in the instance of Jersey City (N. J.) gas, which is up to 180. Chicago Trusts are at 56¼. Boston gas (syndicate common stock) can be purchased at something under 40, and looks to us to be a purchase.

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As Superintendent of Gas Works,

By a man of many years' experience. Has been in charge of works having a daily output of from 10,000 to 600,000 cubic feet. Best of references. Address

747-2 "A. M.," care this Journal.

Position Wanted

As Superintendent of a Gas Works

Or as Gasfitter, or to do general work, by a man who has had sixteen years experience in the manufacture and distribution of gas. First-class references. Address

748-2 PHOTOMETER, care this Journal.

POSITION WANTED,

As Manager or Superintendent of Gas Works.

By a man of large experience in the manufacture and distribution of Coal and Water Gas. Is thoroughly competent to construct new works or remodel old ones. References A1. Address

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ENGAGEMENT DESIRED.

A Superintendent, with several years experience in the manufacture and distribution of both coal and water gas, is open for an engagement Construction or improvements a specialty. References A1. Address

743-tf "C. S.," care this Journal.

POSITION WANTED

As Superintendent of Gas Works,

By a young man who is thoroughly familiar with Oil, Coal, and Water Gas, and has fair knowledge of Electricity. Graduate chemist of School of Mines, N. Y. Address

746 tf "CHEMIST," care this Journal.

Situation Wanted as Manager or Supt.

A young man who is a hustler in the gas business desires a situation as Superintendent or Manager of a Gas Works. Has had experience in the manufacture and distribution of Coal and Water Gas, and the treatment of Natural Gas by the McKay-Critchlow process. Good references furnished and satisfaction guaranteed. Address "D.," care this Office.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

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A Specialty.

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Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

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BENCH CASTINGS, CONDENSERS,

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FOUR-WAY VALVES, GAS VALVES,

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Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

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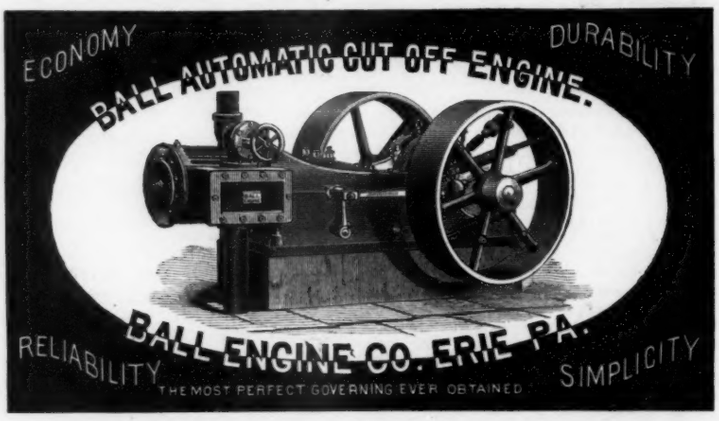
It is to the interest of Gas Companies and Cities to double the efficiency of the light on streets by using Dyott's Patent "CHAMPION" LAMPS. They save 50 per cent. over others in cost of repairs, are ornamental, and indestructible except by violence.

Our Patent System of Instantaneously Lighting Gas (without electricity), for Railroad Depots is unequaled.

Dyott's High Candle Power Burner is a very superior lamp where a concentrated and brilliant light is wanted in Hotels, Stores, Depots, etc.

Special Drawings furnished and Estimates cheerfully given, either from Architects', Engineers', or our Draughtmen's Plans.

We manufacture every description of Plain and Ornamental Lamps, Posts, Brackets, Clusters, etc. Correspondence solicited.



The Seventeenth Annual Meeting of the American Gas Light Association

Will be Held at Baltimore, Md., Oct. 16, 17 & 18.

Persons thinking of joining the Association should read the following extract from the Constitution: "SEC. 12. Applications for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on." Application blanks will be furnished by the Secretary.

Lawrence, Mass. C. J. R. HUMPHREYS, Secretary.

WELSBACH SYSTEM
OF
Incandescent Gas Lighting.

OFFICE, DREXEL BUILDING, PHILA., PA.

At a Meeting of the Gas Trustees of the City of Findlay, held August 28th, it was "Resolved, That we recommend the general adoption of the Welsbach Light, owing to its excellence and economy in the use of gas."

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

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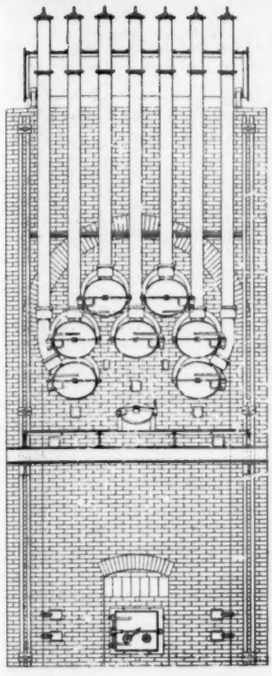

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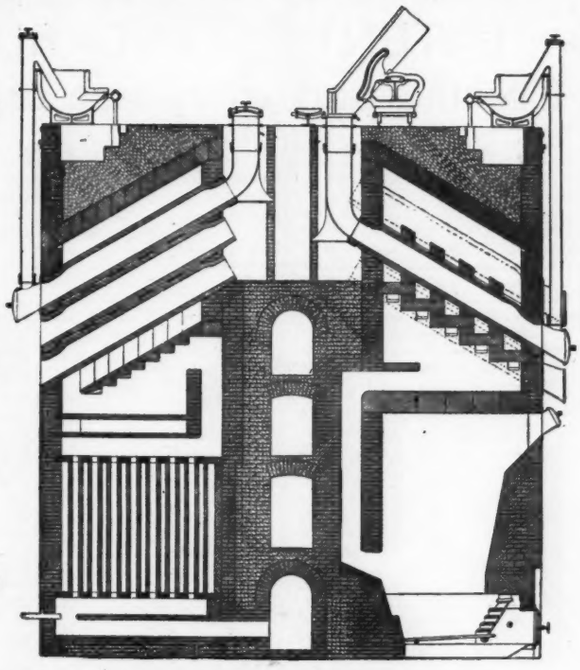
It will Save from 50 to 60 per ct. in Labor.



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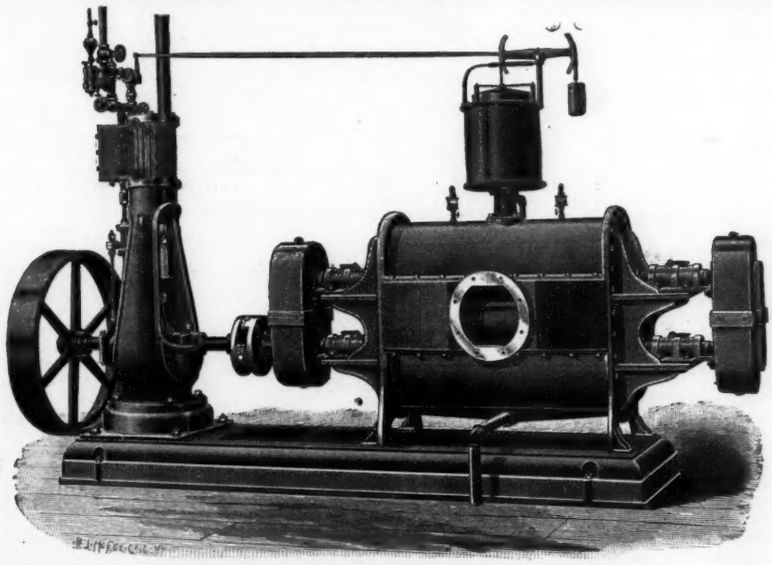

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Erected and in course of construction at present date:

	Capacity. Cubic feet per day.
Altrincham	600,000
Adelaide	600,000
Aldershot	200,000
Allegheny, U. S. A.	1,000,000
Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
Burton-on-Trent	1,500,000
Barcelona	350,000
Barking	100,000
Baerlien & Co	20,000
"	20,000
Bombay	400,000
Buffalo, U.S.A., Mutual	750,000
" **Citizen**	500,000
Brookline, U.S.A.	500,000
Bergen	350,000
Berlin	1,250,000
Bournemouth	1,000,000
Bridgeport, U.S.A	500,000
Brunswick	300,000
Beck & Co., St. Louis	100,000
Barmen Rittershausen	600,000
Bexhill	125,000
Brooklyn, U.S.A	1,000,000
"	1,000,000
" **Nassau**	1,000,000
Brunner, Mond & Co	400,000
Cheltenham	2,000,000
Cannes	200,000
Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A	350,000
Denver, "	500,000
" "	1,000,000
Dusselldorf	750,000
"	500,000
Dumfries	250,000
Dunedin, N.Z	400,000
Darlington	1,250,000
Detroit, U.S.A	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
Gloucester	1,250,000
Gera	300,000
Grafton, N.S.W	100,000
Grieg	300,000
Georgetown, U.S.A	250,000
Gluckauf	200,000
Heywood	600,000
Holywood	125,000
Huy	70,000
Harrow	250,000
Harrogate	250,000
Halstead	150,000
Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
Heckmondwicke	500,000
Haverfordwest	100,000
Halifax, N.S	350,000
Hamm	200,000
Halle	400,000
Heidelberg	300,000
Hartford, U.S.A	1,000,000
Ilkeston	300,000
Inverness	250,000
Ilkley	200,000
Ilford	100,000
Kingston-on-Hull	400,000
Kidderminster	750,000
Kidsgrove	100,000
Konigberg	1,000,000
King's Lynn	300,000

LONDON:—

The Gaslight and Coke Co.:	
Beckton	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	560,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
Manley, N. S. W	100,000
Minneapolis, U. S. A	750,000
Magdeburg	300,000
Memphis, U. S. A	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A	430,000
Newmarket	150,000
Newark, U.S.A	680,000
Northfleet	200,000
New York, U.S.A	2,000,000
Nice	600,000
Newcastle, N. S. W	200,000
Numea, "	100,000
Namur	250,000
Newark	350,000
Oldbury	500,000
Otley	200,000
Oswestry	250,000

	Capacity. Cubic feet per day.
Ober Schlesian	1,500,000
Otto & Co.'s Coke Works	1,500,000
Plymouth	2,000,000
Parramatta, N. S. W	100,000
Prescott	150,000
Providence, U.S.A	750,000
"	750,000
Plauen	300,000
"	300,000
Portsmouth	2,500,000
"	2,500,000
Pittsburgh, U.S.A	1,500,000
Portland, "	560,000
Pawtucket, "	500,000
Quebec	250,000
Radcliffe	750,000
Rouen	250,000
Ramsgate	1,000,000
Reigate	200,000
Richmond, U.S.A	250,000
Roxbury, "	500,000
Runcorn Soap Co	20,000
Rockhampton, N. S. W	125,000
Richmond	1,500,000
Reading	2,000,000
Reichenbach	200,000
Salford	1,750,000
"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland	1,500,000
St. Josephs, U.S.A	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A	2,000,000
"	2,000,000
"	1,000,000
Laclede	1,000,000
Silesian Coal Co	600,000
San Francisco, U.S.A	2,000,000
"	2,000,000
Sheepbridge Coal Co	40,000
Stettin	200,000
Singapore	300,000
Sutton	500,000
Tonbridge	150,000
Tipton	400,000
Tottenham	1,000,000
Toledo, U.S.A	750,000
Toronto	1,000,000
Uxbridge	300,000
Valparaiso	500,000
West Bromwich	1,000,000
Willenhall	250,000
Weston-super-Mare	500,000
Waltham	150,000
Wormwood Scrubs	300,000
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"	600,000
Wellington	150,000
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Walker	300,000
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Windsor, N. S. W	100,000
Wolverton	100,000
Wellington, N. Z	250,000
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Wurzen	200,000
Worcester, U.S.A	750,000
Yeadon	500,000
Yeovil	250,000

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Chippewa Falls Gas Lt. Co.	Chippewa Falls, Wis.
Elkhart Gas Lt & Coke Co.	Elkhart, Ind.
Madison City Gas Light Co.	Madison, Wis.
South Bend Gas Light Co.	South Bend, Ind.
Sheboygan National Gas Co.	Sheboygan, Wis.
Salina Gas Light Co.	Salina, Kansas.
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Jefferson City Gas Lt. Co	Jefferson City, Mo.
Mankato Gas Light Co.	Mankato, Minn.
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Sioux Falls Gas Co.	Sioux Falls, Dak.
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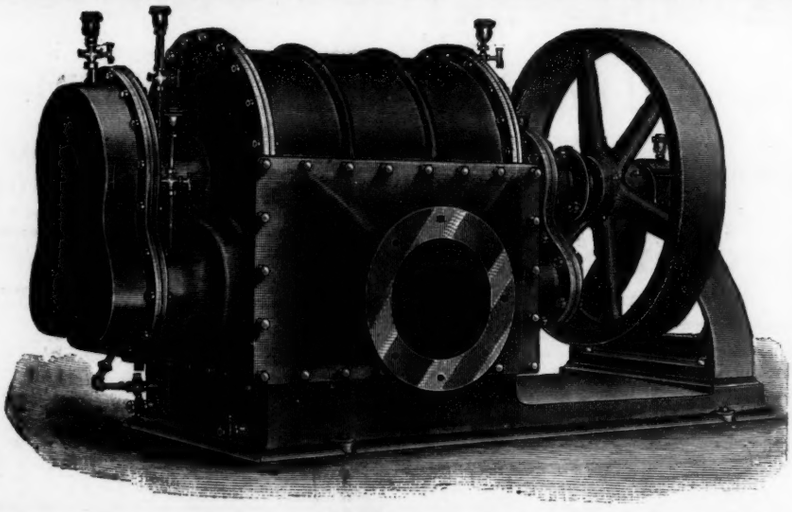

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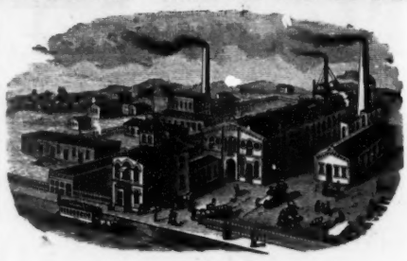

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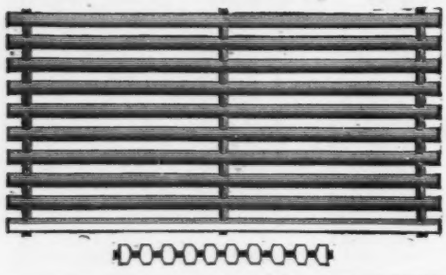

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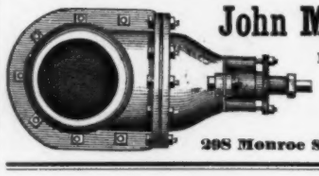

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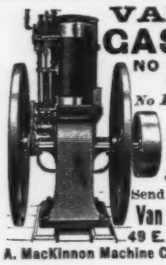

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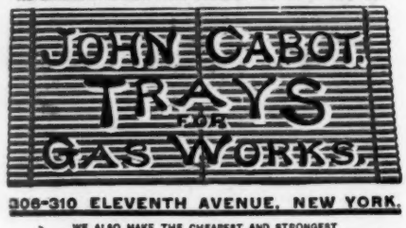

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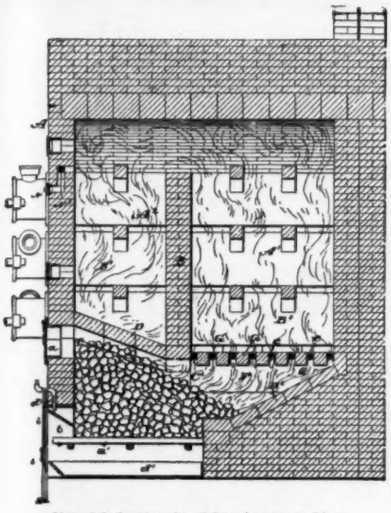

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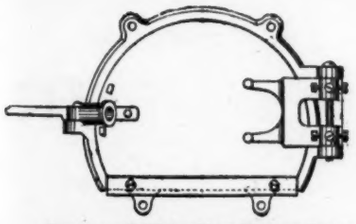

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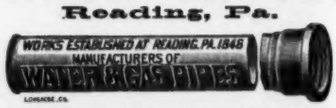

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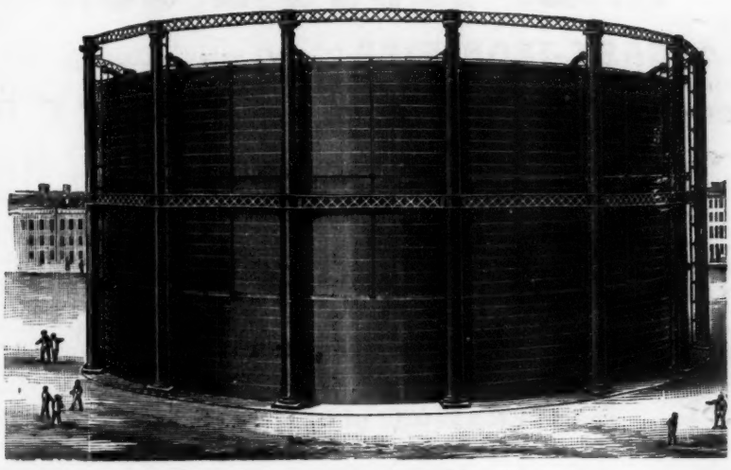

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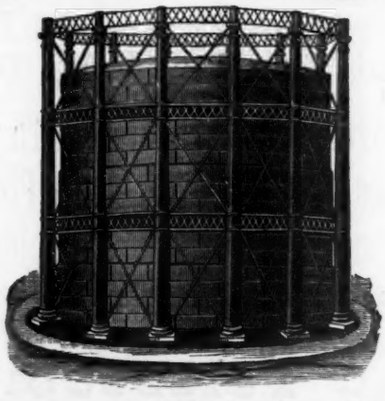

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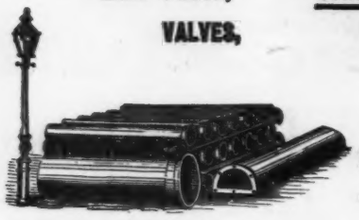

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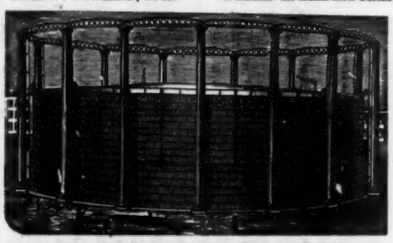
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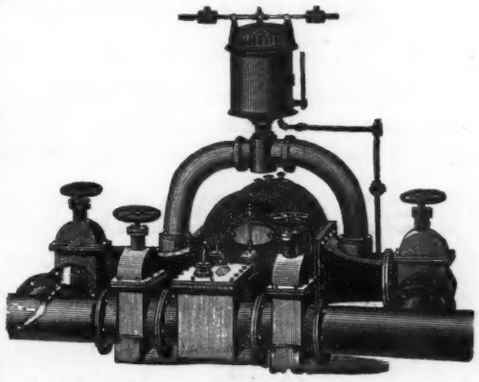

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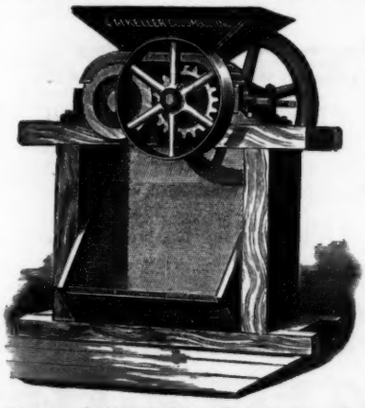

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50-H.P. STEAM ENGINE AND BOILER, Running a Plant of Fifty 2000-C.P. Arc Lamps 12 Hours.	
4,500 lbs. Indiana nut and slack, at $1.30 per ton	$2 93
Engineer, one night, at $50 per month	1 67
Trimmer, one day, at $40 per month	1 33
Superintendent or Electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent, one day, at $40 per year	11
Wheeling coal and removing ashes, at $4 per week	58
100 pairs carbons, at $18.50 per 1000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$10 38

50-H.P. OTTO GAS ENGINE, Running a Plant of Fifty 2000 C.P. Arc Lamps 12 Hours.	
9,200 cu. ft. gas, at 42 cts. per M. (for cost of gas see items below)	$3 86
Engineer not needed; engine is in care of Electrician or Supt.	....
Trimmer, one day, at $40 per month	1 33
Superintendent or electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent dispensed with (cooling water used over and over)	....
Handling of coal included in cost of gas	....
100 pairs carbons, at $18.50 per 1,000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$8 95

Expenses of depreciation, repairs, and interest omitted, being considered the same in both cases—though depreciation and repairs are much higher with steam on account of boiler and its appurtenances. Cost of gas in the holder we estimate for most of the Middle and Western States as follows: Coal, 30 cts.; labor, 20 cts.; purification, 2 cts.; total, 52 cts. Less coke, 7 cts., and tar, 3 cts.; leaving net cost of gas 42 cts. The items of Superintendence and repairs, being paid for by the gas sold to consumers, need not be charged on extra output for gas engine consumption. Where the cost of gas is higher than here figured, coal for steam use will be found proportionally higher, and final figures of comparison show same amount of saving.

Excess in Cost of Steam over Gas Power is thus $1.43, or nearly 16 per cent.

Coal for getting up steam and banking fires is not included in above figures, and should be added, thus increasing rate of economy of gas power beyond that shown by our figures.

Where Gas Companies adopt Gas Power for Electric Plants, Water Works, Sewerage, etc., they not only choose **the most economical power for their use,** but secure to themselves the **numerous advantages of increased production,** without increase of expense, and benefit thereby their entire manufacture. They induce consumers, by their example, to abandon Steam for Gas Power, and, by establishing special rates, make

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